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## I. SUMMARY

Permethrin, a synthetic pyrethroid pesticide, is toll manufactured for ICI Americas Inc. by the Vertac Chemical Corp. Several wastewater streams result from the manufacture of permethrin. All of the waste streams contain materials at concentrations that are reported to be toxic to fish and other aquatic organisms. The volume of wastewater generated from permethrin production at Vertac is about 12,000 gallons per day.

Due to increased economic concern about the present method of permethrin wastewater disposal employed by Vertac (deep-well injection), a study was initiated to determine the most attractive alternative to deep well injection. The study included characterization of the wastewater streams and evaluation of various treatment technologies. Extensive laboratory testing was conducted using activated carbon treatment alone and in conjunction with biological treatment. Biological treatment alone was evaluated. Radiological destruction was evaluated on a very limited basis.

Initially, the study was directed at treatment of only the wastewaters resulting from permethrin process operations. Based on results of the treatability work, the study was re-directed to place primary emphasis on treatment of the permethrin wastewater in the Vertac wastewater treatment system. Additional treatment technologies were not evaluated due to the results of the biological treatment program.

The results of the study indicate that biological treatment with or without activated carbon pretreatment is a feasible alternative to deep-well disposal. Organic removals (as COD and BOD) of greater than 90% can typically be expected. Based on laboratory results, permethrin wastewater can also be successfully treated when combined with other Vertac wastes in the Vertac wastewater treatment plant. Organics removals in this instance are typically greater than 80%.

Permethrin and its analogs were removed in the laboratory scale biological treatment systems, but not to levels reported to be non-toxic to fish. It is possible to reduce the permethrin concentration of the wastewater to below toxic levels using activated carbon, but very high dosages are required. While activated carbon removes permethrin and its analogs, it does not significantly reduce the organic content of the wastewater. Pretreatment of the wastewater with carbon resulted in a slight improvement in the removal of organics in the biological treatment system.

The permethrin wastewater also contains chlorides and some metals in concentrations that are reported to be toxic to fish.

This testing demonstrated that the biological treatment system could operate satisfactorily with these levels of contaminants.

The degree of permethrin destruction obtained using radiological treatment is not considered sufficient to warrant further testing.

The basic recommendations resulting from this study are to:

- o Implement treatment of the permethrin process wastewater in the Vertac biological treatment system.
- o Investigate alternative methods of reducing and/or controlling the permethrin content of the permethrin process wastewater.
- o Install the necessary equipment for collection and analysis of the permethrin process wastewater prior to introduction into the Vertac treatment system. Wastewater found to be unsatisfactory for introduction into the system will require alternative disposal. Pretreatment with activated carbon may be an appropriate alternative.



## II. INTRODUCTION

Permethrin, a synthetic pyrethroid insecticide, is toll manufactured for ICI Americas Inc. by Vertac Chemical Corporation at their West Helena, Arkansas Plant. All of the permethrin process wastewater is collected at the site, neutralized and sent off-site for deep-well disposal. Rising transportation and well-head costs prompted this investigation of alternative treatment methods to realize the cost savings associated with a less expensive treatment alternative.

The objective of this study was to evaluate alternatives to deep-well injection for disposal of wastewater generated during the production of permethrin. Initial efforts were directed toward treatment of the permethrin wastes alone to avoid possible contamination of the Vertac wastewater treatment plant. The study was later modified to place primary emphasis on treatment of permethrin wastewater combined with other site wastewaters in the Vertac treatment system. This report presents the results of an evaluation of the various treatment alternatives and pertinent data obtained during the course of the study.

## III. BACKGROUND

### A. Permethrin Process

The permethrin process consists of the alkaline hydrolysis of the permethrin acid ester to permethrin acid, the acidification of the permethrin acid via reaction with thionyl chloride to permethrin acid chloride, followed by the conversion of the permethrin acid chloride via reaction with 3-phenoxybenzyl alcohol to permethrin.

Wastewater from the process consists of brine washes, scrubber liquor, steam jet condensate (including pad drainage) and aqueous layers from toluene strips. Table 1 contains a listing of the various point sources of wastewater and approximate daily discharges in pounds and in gallons.

### B. Toxicity of Permethrin and Its Analogs

Various toxicity studies have been performed on permethrin and its analogs. Of primary interest are those which used aquatic species (see Table 2) since the majority of wastewater treatment technologies provide for eventual discharge of the treated wastewater to a receiving body of water. It



can be seen from Table 2 that permethrin is more toxic than the analogs and its removal from the wastewater is of primary concern. Permethrin acid removal ranks second in importance since it is a degradation product of both permethrin and permethrin acid chloride, as well as a hydrolysis product of the permethrin acid ester.

#### C. Literature Search and Previous Studies

A literature search was conducted to determine if any permethrin-specific treatability studies had been performed in the past. Other than limited work performed by ICIA on various process effluents, none was found to be published. A review of the literature, however, produced diverse treatment schemes for other pesticides. These treatment methods were considered as options for the disposal of the permethrin wastewater.

The bulk of the available information on permethrin dealt with its degradation in soil and toxicity studies for product registration application to the EPA. A Permethrin Process Package prepared in January, 1977, by the Chemical Engineering Laboratories at Atlas Point indicated that effluents were to be saved until a suitable disposal technique was developed. Disposal of the waste effluents from permethrin manufacturing at Huddersfield Works in the UK is to either the "effluent drain" or the "Central Neutralizing Plant" prior to transfer of the wastes to a local sewage works for treatment. Treated effluent is eventually discharged to a river.

An initial review of the environmental aspects of permethrin was performed by Environmental Engineering in early 1977. At that time three types of treatment: Alkaline Hydrolysis, Biological Degradation and Activated Carbon Adsorption were proposed for investigation.

Effluent samples were obtained from the UK for use in the hydrolysis study. A weighted composite of the three principal process waters, i.e., hydrolysis step acid and brine washes and permethrin final brine wash, was used in this study. Base catalyzed hydrolysis of permethrin results in a breakdown of the molecule into 3-phenoxybenzyl alcohol and permethrin acid. An idealized kinetic study of the hydrolysis in deionized water gave measureable results, however, similar studies done in the actual process effluent were inconclusive. The disappearance of the permethrin could not be measured because of interference from other impurities. It was recommended to conduct trial treatments with subsequent neutralization and fish toxicity evaluations, but this was not pursued further.



The biological degradation study was performed using permethrin process effluent composites obtained from Vertac and consisted of microbial inhibition testing, air stripping and bench-top biological treatment with treated effluent fish toxicity testing. Results of the microbial inhibition testing indicated inhibition at permethrin process effluent concentrations exceeding 10% by volume, thus dilution of the waste would be required for successful biological treatment.

Air stripping was also performed to determine the extent of removal of volatile organics in the wastewater. Experimental results showed a 47% reduction in COD after 4 hours and a 68% reduction after 24 hours. This indicates that if the wastewater is introduced into an aerated biological treatment system, a significant fraction of the organics may be removed before the biological mass can utilize them as a source of energy and carbon for cell synthesis.

The bench-top biological treatment study commenced with a 40-day sludge acclimation period using a ten-fold dilution of the permethrin wastewater composite. Following this a batch reactor was set up using the acclimated sludge and fed with the diluted wastewater at a food to microorganism (mass of biochemical oxygen demand, BOD, to mass of volatile suspended solids, VSS, under aeration) ratio of 0.40. The combined action of biological degradation and air stripping resulted in greater than 95% COD removal after 4 hours. Permethrin was reduced from an initial concentration of greater than 0.1 mg/l to a residual concentration of less than 0.02 mg/l.

The batch reactor was operated for a time period to produce sufficient effluent for static bioassay studies. Fathead minnows, Pimephales promelas, were used as the test organism. The results of the bioassay were not considered valid since all of the fish in the control unit died; the testing was not repeated due to the lack of sufficient effluent sample.

The proposed evaluation of activated carbon adsorption for permethrin wastewater treatment was to commence after the biological evaluation. At that time a toll manufacturer, Vertac Chemical Corp., had been selected for the production of permethrin with deep-well disposal being used for the disposal of the process effluents. Therefore, the adsorption study was not conducted.



Research into carbon adsorption for pesticide removal from wastewater was also conducted at the ICIA Biological Research Center in Goldsboro, NC. Activated carbon adsorption, followed by biological degradation, was evaluated for treatment of the wastewater generated at the research facility. The wastewater contained herbicides such as triazines, substituted ureas and dinitroanilines, fungicides such as dithiocarbamates and pyrimidines and insecticides including carbamates, synthetic and natural pyrethroids, organophosphates and biologically derived pesticides. Based on the results of this testing, a treatment system consisting of activated carbon adsorption, using a dosage of one gram per liter, followed by an activated sludge system and effluent polishing was installed. During the initial six-month operating period the average concentration of the synthetic pyrethroids in the influent to the treatment plant was about 700 parts per billion. The activated sludge effluent averaged about 1.9 parts per billion.

Results of previous studies indicated that activated carbon and/or biological treatment might be feasible disposal technologies for permethrin process wastewater. These treatment methods were included in the proposed test program.

#### D. Vertac Wastewater Treatment System

The Vertac wastewater treatment system is a biological system consisting of an equalization pond (8,000,000 gallons capacity) followed by an aeration pond (600,000 gallons), clarification and a final polish pond (4,000,000 gallons capacity). Discharge from the final polish pond is pumped to the Mississippi River.

The system operates with no provisions for nutrient supplementation or excess solids disposal. The clarifiers are used to return biological solids to the aeration basin.

The polish pond is used as a settling basin for solids overflowing the clarifiers with some organic removal due to anaerobic degradation.

#### IV. CHARACTERIZATION OF PERMETHRIN PROCESS WASTEWATER

Previous analyses of the wastewater had been performed on composites of the various process effluents, but were minimal in information. In order to determine whether all, or only portions, of the wastewater could be successfully treated by specific treatment technologies it was necessary to thoroughly characterize each process wastewater stream. Ten process wastewater sources, as listed in Table 3, were identified for



characterization. Some of the sources were to be eliminated in the future by either recycling or reprocessing. Based on the source of the wastewater, various analyses were performed on samples from two or three different permethrin production runs at Vertac. The results of these analyses are presented in Table 4.

It can be seen that each of the various wastewater sources contains permethrin analogs in concentrations above the fish toxicity limits listed in Table 2. Thus, no one effluent source could be selected for possible treatment on an individual basis to eliminate the toxic characteristics of the wastewater. Carbon adsorbable organics analyses indicated that some compounds, not specifically identified, are removed by carbon adsorption. Therefore, the use of activated carbon adsorption as a treatment alternative was to be investigated. Organics concentrations, as chemical oxygen demand (COD) or total organic carbon (TOC), due to the methanol and toluene, were more than sufficient to warrant examination of biological treatment. However, the nitrogen and phosphorus levels in the wastes indicated that nutrient supplementation would be necessary for biological treatment. The effects of the high organic concentrations on various disposal options would have to be considered as would the other analytical results, in determining which disposal options to investigate further.

#### V. OPTIONS FOR DISPOSAL

Various pesticide treatment systems are cited in the literature, however, not all work as efficiently for one class of pesticides (halogenated organic, organophosphorus, organonitrogen, etc.) as they do for another. In fact, treatment systems for pesticides within a class grouping are frequently dissimilar in order to achieve maximum removal of the specific pesticide. Very little has been published on the removal of pyrethroids. The typical treatment is either incineration or deep-well injection.

Disposal options for pesticides which might apply to permethrin process wastewater are listed in Table 5. Most are standard wastewater treatment technologies and are usually used in combinations to produce a system for total toxicant removal as part of the wastewater treatment process. Two of the options, metallic couples and gamma radiation, are somewhat experimental at the present time. Their applicability has been demonstrated at the bench-top and pilot plant scale, however, the results of plant scale investigations have not been published.

In selecting disposal options for further evaluation several items had to be considered. Specifically considered were the results of previous studies, the wastewater characteristics and ease of operation and completeness of the treatment system.



Additionally, rather than evaluate every selected disposal option on each of the six wastewater sources listed in Table 1, only combinations of the various wastewater streams were to be evaluated. Production process flow conditions indicated that aqueous brine washes should be combined. A second combination was the scrubber liquor and the water layers from the toluene strips and the steam jet condensate. A third combination consisted of a composite of all six sources.

Of specific interest were the organics (as COD), chlorides and permethrin and its analogs concentrations which could be expected in each of the three combinations. Using results from the characterization analyses these concentrations were calculated and are listed in Table 6. These are average concentrations based on three samples from each source. The concentrations were used to determine which disposal options warranted further evaluation. Not all permethrin analog analyses were performed on each sample.

Table 7 outlines the initial program for evaluation of those treatability processes considered most likely to be feasible for treating the permethrin wastewater. Previous soil adsorption and degradation studies indicated that the permethrin would probably be amenable to activated carbon and biological treatments. However, it was not known what effect the high chloride concentration of the waste would have on these disposal options. Reverse osmosis was eliminated as a treatment process since all organics with a molecular weight greater than 200, i.e., permethrin analogs, would be retained in the concentrated salt solution, which was intended for reuse in the process, rather than in the permeate. Ion exchange desalination treatments, however, were included in the disposal options for evaluation since the salt could possibly be reclaimed for reuse and the effluent liquor be treated further by activated carbon and/or biological means. Chemical treatment, incineration and radiological destruction (photolysis) were to be examined only if the above treatment alternatives were not satisfactory.

## VI. TEST PROGRAM

### A. Characterization of Wastes

All permethrin process wastewater used as influent feed during the treatability study was analyzed for various parameters. These analyses were performed in order to confirm and update the data from the initial characterization study. Also, all of the Vertac plant wastewater which was used during the study was analyzed for various parameters to more fully characterize their waste. The wastewater was taken from the equalization pond at the Vertac plant.



## B. Activated Carbon Treatment Evaluation

Activated carbon adsorption was selected as the treatment option for initial evaluation. If this option proved successful in removing toxics (permethrin and its analogs), the wastewater might then be amenable to treatment in a biological treatment system. It would be necessary to dispose of spent carbon using this option. Landfarming, secure landfill or incineration are possible disposal methods for the spent carbon.

A screening study was conducted at the Vertac plant using fresh waste samples to prepare the combined wastewater streams; i.e., brines, scrubber/condensates and all streams combined. The objective of the screening study was to select an activated carbon which would be effective in removing permethrin analogs from the wastewater. Eight ICIA DARCO® activated carbons (HDB, HDC, HDH, HDJ, G-60, KB, S-51 and HD-3000) were evaluated. Rapid COD analyses were performed at Vertac on as is, filtered and activated carbon treated and filtered composite samples. This data was used as the basis for the later phases of the screening study. Some samples were sent to the Atlas Point Analytical Laboratory for COD and BOD<sub>5</sub> analyses and microbial inhibition testing and the to the Corporate Research Laboratory for permethrin analogs analyses by GLC.

Based on the results of the screening study, portions of each batch of permethrin wastewater used in the subsequent testing were treated with 4 grams per liter of the HDC and analyzed for various parameters. Testing was performed to develop a permethrin adsorption isotherm for the HDC. Samples of some effluents collected during the biological testing were also treated with HDC to evaluate the use of carbon as post treatment to a biological treatment system. Additionally, each of the spent carbon samples was air-dried and subjected to the EPA Extraction Procedure test to determine whether significant amounts of adsorbed contaminants would leach from the carbon.

## C. Biological Treatability Evaluation

### 1. Microbial Inhibition Testing

The microbial inhibition testing was conducted to provide preliminary data on the potential toxicity to microorganisms associated with biological wastewater treatment. Rather than determining the microbial toxic limit of the three wastewater combinations, a logarithmic series of four dilutions was established for each



combination. The dilutions were based on the daily flows of each combination of waste streams combined with the expected Vertac influent flow rate of 90,000 gallons per day. Under expected operating conditions the brines, scrubber/condensates and total composites would comprise approximately 6.5%, 6.0% and 11.8%, respectively, of the volume of influent to the Vertac waste treatment system. If no microbial inhibition occurred at these percentages it would be considered safe to proceed with the biological treatability studies.

2. Laboratory Scale Determination of Optimum Food-to-Microorganism Ratio

In January 1980, laboratory-scale biological treatability studies were initiated. For convenience, the studies were conducted at the Atlas Point site on wastewater samples received from Vertac. Six ten-liter bench-top activated sludge units were started using municipal sewage sludge as seed. Four units, Tanks 3-6, were fed activated carbon treated permethrin wastewater at F/M ratios of approximately 0.25, 0.40, 0.55 and 1.0, respectively, to determine the optimum organics loading to provide adequate treatment in a biological system. Another unit, Tank 2, was fed only "as is" permethrin wastewater at an F/M of approximately 0.40 to ascertain its effect on a biological treatment system. The remaining unit, Tank 1, was fed a composite of activated carbon treated permethrin wastewater and Vertac process waste from the wastewater treatment plant equalization pond to determine if the permethrin wastewater could be combined with the Vertac wastes and treated in a biological system.

All feed solutions to the activated sludge reactors were neutralized to a pH of approximately 7 and were supplemented with sufficient nitrogen and phosphorus to satisfy the BOD (biochemical oxygen demand):N:P ratio of 100:5:1 prior to their introduction. Flow rates to the units were established based on expected mixed liquor volatile suspended solids, MLVSS, levels ( $\sim 3000$  mg/l), organics concentration ( $\sim 50,000$  mg/l BOD<sub>5</sub>), permethrin wastewater flow ( $\sim 12,000$  gpd), current Vertac wastewater flow ( $\sim 7,000$  gpd) and the size of the aeration section of the bench-top unit ( $\sim 7.5$  liters) versus that of the Vertac Plant aeration basin (500,000 gallons). Flow rates were kept constant during the study and mixed liquor suspended solids were removed from the units, as required, to maintain an MLVSS level of about 3000 mg/l.



3. Laboratory Scale Operation at Optimized Food-to-Micro-organism Ratio

Based on the results of the initial phase of the biological treatability study and to gather additional data, Tanks 2 and 3 were kept operating until November, 1980.

In March, the flow rates to both units were identically set to operate at an F/M of about 0.25, based on the organic level of the feed at that time. The flow rates were kept relatively constant during the remainder of the study. The mixed liquor suspended solids were removed, as required, to maintain an MLVSS concentration of about 3000 mg/l. When the solids decreased below the 3000 mg/l level, no attempt was made to adjust the flow rates to compensate for solids loss. Thus, part-way through the study period the F/M values for the units became greater than 0.25.

4. Scaled-Up Operation at Optimized Food-To-Microorganism Ratio

Based on initial test results the emphasis of the study was directed toward treatment of the permethrin wastewater at the Vertac Plant. In order to gather sufficient data on biodegradation of the permethrin analogs it was necessary to scale-up the study to collect adequate amounts of effluent for GLC analyses and to conduct fish bioassays. A 25-gallon reactor, Tank A, was started using municipal sewage seed. Influent feed consisted of a 50/50 composite of activated carbon treated permethrin wastewater and Vertac plant equalization pond wastewater based on expected waste flows of 12,000 gpd for each. The flow rate to the unit was proportionately set based on a comparison of the volumes of the Tank A aeration section and the Vertac aeration basin. Further into the study a side-by-side comparison of "as is" and activated carbon treated permethrin wastewaters, respectively, combined with Vertac plant wastewater was initiated. The contents of Tank A were split in half to start a second 25-gallon unit, Tank B, which would be fed a 50/50 composite of "as is" permethrin and Vertac plant wastewaters.

5. Fish Bioassays

Effluents from Tanks A and B treating combined Vertac and permethrin wastewaters were retained throughout the test period for fish bioassay testing. Aeration was



provided to the effluent collection containers to keep the effluent from turning anaerobic. Various chemical analyses were also performed on the effluents for correlation to fish bioassay results.

This testing was conducted to determine the toxicity of the treated effluents to the test organism, fathead minnows (Pimephales promelas) in terms of an acute, static 96-hour LC<sub>50</sub>. The testing was conducted by an outside consultant.

#### D. Radiological Destruction of Permethrin Process Wastewater

Several literature references indicated that degradation of pesticides by photolysis (ultraviolet light) is possible. A vendor of ultraviolet disinfection equipment was contacted to determine if the destruction of the toxic constituents in permethrin wastewater was feasible through the use of ultraviolet radiation. The vendor employed a thin-film, high-intensity ultraviolet reactor unit which was used either alone or in conjunction with an oxidizing agent, hydrogen peroxide, for treatment of wastes. A sample of as is permethrin wastewater was subjected to ultraviolet treatment and to chemical oxidation coupled with ultraviolet treatment.

### VII. RESULTS AND DISCUSSION

Initially the test program was established with the primary intention of developing a feasible treatment technology for only permethrin process wastewater. Treatment of the permethrin wastewater in the Vertac wastewater system was considered to be of lesser importance. However, as the program progressed and the data was evaluated, treatment of the permethrin wastewater in the Vertac system appeared more and more attractive until it finally became the primary objective.

#### A. Analytical Procedure Development

During the course of this study the analyses for permethrin and its analogs were performed using gas-liquid chromatography. Initial analyses were performed using a modification of the analytical method used at the Goldsboro Biological Research Center. The Goldsboro method had been patterned after one that was developed by the Plant Protection Division in the UK and had a reported limit of detection of 0.01 ppm for permethrin. For the wastewater samples analyzed as part of this study, the limit of detection with this method was only 0.1 to 0.2 ppm.

As the study progressed, it became evident that a more sensitive procedure was needed for determining permethrin at the 0.5 to 1.0 ppb level in wastewater. The Corporate Research Department was requested to develop an analytical procedure with this level of sensitivity. This was necessary in order to quantify the permethrin levels in the



wastewater samples and to determine the permethrin removal within the treatment systems. Also, the low permethrin concentrations would have to be quantified for use in evaluation of the fish bioassay testing.

A method was developed which measured permethrin at concentrations less than 1.0 ppb. This method was used throughout the later stages of the study and is the reason that the data contained in this report reflects varying levels of detection for permethrin.

The results of the permethrin analyses throughout the course of this study were typically obtained as much as several weeks behind the corresponding segment of the treatability program. As a consequence, the effect of a change in the treatment of the wastewater could not be evaluated in terms of permethrin removal until a significant period of time had elapsed following implementation of the change.

## B. Characterization of Wastes

### 1. Permethrin Process Wastewater

Analytical results for the analyses of permethrin process wastewater are listed in Table 8. The wastewater is high strength in terms of organic content and spans the range of very acidic to highly alkaline. It is deficient in nutrients and contains chlorides, permethrin and metals in concentrations considered toxic to aquatic life. Nutrient supplementation, in terms of nitrogen and phosphorus, is necessary for biological treatment of the wastewater and must satisfy the BOD:N:P ratio of 100:5:1. Based on average analytical results the permethrin process wastewater is in need of approximately 2050 mg/l of nitrogen and 420 mg/l of phosphorus.

Chloride content is extremely high, averaging about 63,000 mg/l, and although it has been demonstrated during this study that a biological treatment system can operate at these concentrations, a problem could result with discharge of treated effluent. The LC<sub>50</sub> for chloride at 96-hours using fathead minnows is approximately 4600 mg/l. Therefore, depending on the relative size and quality of the receiving stream to the treatment system discharge, the chlorides could have a significant adverse impact on the receiving stream.

Some of the metal concentrations are above the reported toxic limits listed in Table 9. Raw materials and process equipment are the only possible sources for the metals. Further evaluation is necessary to determine the source of the metals.



Permethrin concentration in the wastewater averaged approximately 78 mg/l. The concentrations ranged from less than 0.2 mg/l to 835 mg/l. Improved process monitoring and control and/or pretreatment, possibly with activated carbon, may be necessary to reduce the potential for shock loading a biological treatment system. The shock loads can result in adverse affect to a biological treatment system.

## 2. Vertac Plant Wastewater

Analytical results for the analyses of the Vertac plant equilization pond wastewater used in the study are listed in Table 10 and indicate it to be a mildly acidic, low strength organic waste. It is also deficient in nutrients, nitrogen and phosphorus.

Based on average analytical results the wastewater is in need of approximately 47 mg/l of nitrogen and 17 mg/l of phosphorus to satisfy the BOD:N:P requirements for biological treatment.

## C. Activated Carbon Treatment Evaluation

### 1. Activated Carbon Screening

The results of the activated carbon screening are presented in Table 11. The initial carbon dosage used in the screening was 1 gm/l. The results of the initial testing indicate that some organic removal occurred by filtration alone and that all eight carbons were very close in organic removal efficiency. However, organics removal, determined by rapid COD, due to carbon adsorption alone was negligible except for the scrubber/condensates composite. Since all eight activated carbons were judged to be equivalent in organic removal, the two least expensive, HDB and HDC, were selected for further evaluation. An attempt was made to develop an adsorption isotherm on the scrubber/condensates composite using HDB and HDC at four different dosages (0.5, 2.0, 4.0 and 10.0 gm/l), but results were inconclusive.

In fact, the isotherm data indicates that the initial scrubber/condensates screening COD values were in error. The screening was reevaluated using all eight carbons at a dosage of 40 gm/l on each of the three composite samples. This data further indiates an apparent error in the initial screening results for the scrubber/condensates.



The results of the testing at 40 gm/l indicated slightly better organics removals than that obtained at the 1 mg/l carbon dosage. In order to confirm the organics removals and determine the efficiency of removing permethrin analogs, several samples were sent to Atlas Point and Corporate Research for analyses. COD and BOD<sub>5</sub> analyses confirmed the minimal organics removals. Since the bulk of the organics was considered to be toluene and methanol, which are not carbon adsorbable, it was postulated that the activated carbon might be selective in removing the permethrin analogs. GLC analyses indicated that adsorption of the permethrin analogs was indeed occurring. It appeared that HDC at a concentration of 4.0 gm/l would be sufficient for the removal of permethrin analogs and that this activated carbon and dosage would be used in further treatability studies. This is based on the fact that all of the analog concentrations were below the detection limits except permethrin acid, PA. The PA was removed to below the detection limit at a dosage of 4 gm/l in the scrubber/condensate composite.

## 2. Activated Carbon Treatment

Results of the analyses of each batch of activated carbon treated, 4 gm/l of HDC, permethrin wastewater used in the biological study are listed in Table 12. When these results are compared to those found for the corresponding permethrin wastewater, Table 8, it can be seen that organics removal due to the carbon treatment is minimal; however, permethrin concentrations are significantly reduced by carbon treatment. The 4 gm/l dosage removed the permethrin to levels considered to be acceptable for a biological treatment system for all of the samples tested with the exception of the 1/23-1/24 sample containing 835 mg/l.

Samples of the effluents from Tanks A and B were also treated with activated carbon, 4 gm/l of HDC, and analyzed for COD, BOD and permethrin. These results presented in Table 13, indicate a slight reduction in organics and some permethrin removal. This is attributed to the adsorption process, however some small reduction was probably due to removal of the biological solids from the sample during filtration to remove the activated carbon.

Activated carbon can be used either as pretreatment or post-treatment to a biological treatment system for removal of permethrin from wastewater. The advantage of



using carbon for pretreatment is that it will eliminate shock loads and the resulting system upsets due to high permethrin concentrations. The advantage to post-treatment is that the permethrin has been partially removed within the biological system and the carbon dosage will be less than that required for pretreatment.

In order to evaluate land disposal of the activated carbon used for treating permethrin wastewaters, EPA extraction procedure tests were performed on all the spent carbon samples used during the test program. The leachate from each test was analyzed for COD, BOD and permethrin. The results of these analyses are presented in Table 14. Although some organics and permethrin were leached from the carbon in every test, the quantities do not indicate a significant environmental concern. If activated carbon is employed in the treatment of permethrin wastewater, approval for disposal of the spent carbon will have to be obtained from the appropriate regulatory agency.

### 3. Permethrin Adsorption Isotherm

Based on the results of the permethrin wastewater characterization and activated carbon treatment data, an activated carbon permethrin adsorption isotherm was developed for a sample of wastewater that was "spiked" with permethrin. The spiking was necessary to obtain a permethrin concentration that approximated the average concentration, 78 mg/l, as determined by the characterization data. The data used to develop the isotherm is presented in Table 15. As with the earlier screening work, there was no significant organics removal, even at very high carbon dosages.

The permethrin adsorption isotherm is shown graphically in Figure 2 along with the data from the activated carbon treatment program. Based on this plot, to achieve a final permethrin concentration of about 20 ug/l, sufficient carbon must be used so that the amount of permethrin removed is about 0.014 grams per gram of carbon (or lb. per lb., etc.). Therefore, if the initial permethrin concentration is 78 mg/l, a carbon dosage of about 5600 mg/l is required. To achieve 2 ug/l the permethrin removed per unit of carbon is about 0.004. The 2 ug/l level is below the reported toxic levels for most of the aquatic organisms as presented in Table 2. As evident from Figure 2, there is scatter in the data points. It may be that some of the permethrin in the



different wastewater samples exists in different physical states making it more, or less, susceptible to adsorption by the activated carbon. Additional testing work will be necessary to develop more isotherm data for determining carbon dosages if activated carbon is to be used in the treatment of permethrin wastewaters.

#### D. Biological Treatability

##### 1. Microbial Inhibition

Results for the microbial inhibition testing are presented in Table 16. The data indicates that there should not be any significant microbial inhibition at the expected percentages of the permethrin wastewater streams in the total wastewater used in the testing. The composites are the same as those used in the activated carbon screening.

##### 2. Laboratory Scale Treatment

The analytical data obtained during this portion of the test program is presented in Tables 17 thru 20. Tanks 3 thru 6, treating only activated carbon treated permethrin at various F/M values showed good organic removals (see Table 17). However, those units at the higher organic loadings, Tanks 5 and 6, did not perform as well as the others. A plot of F/M versus organic removals for these units (Figure 3) indicates that COD and BOD removals of greater than 90% can be expected in a treatment system operating at an F/M of up to about 0.50. In order to gather long-term data, Tank 3 operation was continued at an initial F/M set at about 0.25. Tanks 4-6 were taken out of service.

The results listed in Table 17 for Tank 3 demonstrate continued good organic removals during the long-term operation. Figure 4 shows COD and BOD removals for this unit through the test period, while Figure 5 indicates the organic removals versus F/M values. This unit demonstrated greater than 90% organic removal, average, up through F/M values greater than 3. Only two of the BOD values indicated less than 90% removal. This is not consistent with the earlier optimization results.

Possible explanations of this inconsistency are: (1) the initial optimization activity was not conducted for a sufficiently long period to allow for proper acclimation of the microorganisms in those tanks operating at the higher F/M levels, or (2) significant air stripping



of the methanol and toluene is occurring within the biological treatment system. If air stripping is a significant factor, it should have been reflected in the initial optimization data. Organics removal solely as a result of air stripping was not evaluated as part of this study.

The GLC analytical results for Tank 3 as shown in Table 17, indicate that permethrin is being removed in the biological system. Influent permethrin concentrations ranged from less than 0.1 ppm up to 210 ppm, with effluent concentrations at midpoint and near the end of the study being 2.55 ppb and 4.7 ppb, respectively.

Tank 2, treating only permethrin wastewater, demonstrated good organic removals even when high concentrations of permethrin analogs were introduced into the unit. The operation of this unit was also continued in order to gather long-term data. Results, listed in Table 18, demonstrate good organic removals throughout the test period. Figure 6 shows good COD and BOD removals for this unit during the test. It can be seen that COD and BOD removals are typically greater than 85%. Several data points below this level of removal are due to a large decrease in the COD and BOD of the influent without a corresponding change in the effluent. This is the result of the long hydraulic detention time in the unit.

A plot of F/M versus organics removals (Figure 7) indicate that COD and BOD removals averaging greater than 90% can be expected at F/M levels as high as 3. Levels greater than 3 were not experienced during the operation of this unit. Levels greater than 1 were only the result of a reduction in the MLVSS to less than 1000 mg/l. Even with this reduction, the organics removals remained consistently high. Again, air stripping may have been a factor in the removal of organics.

The GLC analytical results for Tank 2, as shown in Table 18, indicate that permethrin removal is occurring. Influent permethrin concentrations ranged from less than 0.2 ppm up to 600 ppm, whereas the effluent concentrations at midpoint and near the end of the study were 0.3 ppm and 0.12 ppm, respectively.

Tank 1, treating a composite of activated carbon treated permethrin and Vertac wastewaters initially produced organic removals greater than 94%, as COD (see Table 19) but started to decrease in removal efficiency towards the end of the study. This is considered to be a



#### 4. Fish Bioassays

Acute 96-hour, static fish bioassays, using fathead minnows, were performed on the effluents from Tanks A and B by Environmental Consulting and Testing Service. Results are presented in Table 23, and indicate the effluents to be very toxic. A review of the chemical analyses of the effluents, presented in Table 13, indicated the low pH as a possible cause of the toxicity. Thus, the two effluents were neutralized to a pH of 7 and the fish bioassays were repeated. Results were improved over the initial tests but still indicted significant toxicity. The high concentrations of permethrin, chlorides and metals, copper and zinc, as indicated in Table 23, were all considered to be contributing to the toxicity of the wastewater. Although the permethrin levels are above those reportedly toxic, as indicated in Table 2, the permethrin alone cannot be considered as the sole cause of the fish mortalities.

#### E. Radiological Destruction

A sample of permethrin wastewater was submitted to Pure Water System, Inc. for evaluation of radiological treatment as a treatment alternative. The permethrin wastewater was subjected to 10 minutes of ultraviolet radiation and treatment with 2.5%  $H_2O_2$  followed by 5 minutes of ultraviolet radiation. Results of the test are presented in Table 24. Although reductions of permethrin occurred, they were not considered sufficient to warrant further investigation. This was based on the preliminary results of the biological treatment evaluation which indicated good performance and much greater permethrin removals.

### VIII. CONCLUSIONS

The conclusions of this permethrin wastewater treatability study are as follows:

Permethrin process wastewater is high strength in terms of organic content and it contains chlorides, metals and permethrin in concentrations considered toxic to fish.

The permethrin process wastewater at Vertac is subject to containing very high, "shock" loads of permethrin and its analogs.

Activated carbon treatment can be used either as pre- or post-treatment to a biological system to remove permethrin and its analogs from the wastewater. Activated carbon treatment does not significantly reduce the organic content of the wastewater.



Permethrin process wastewater, with or without activated carbon pretreatment, can be adequately treated for organics removal in a biological system. COD and BOD removals of greater than 90% can typically be expected.

Pretreatment of permethrin process wastewater with activated carbon results in a slight improvement in COD and BOD removal in the biological treatment systems.

Permethrin and its analogs were removed in the biological treatment systems, but not to levels below those reported to be toxic to fish.

Permethrin process wastewater combined with Vertac plant waste can also be treated in a biological system. COD and BOD removals of greater than 80% can typically be expected.

The undiluted effluent from a biological treatment system treating permethrin process wastewater combined with Vertac Plant wastewater (1:1 by volume) was toxic to fish. The toxicity of the waste was considered to be primarily related to the concentrations of permethrin, chlorides, and metals.

Radiological treatment of permethrin process wastewater does destroy permethrin and its analogs. However, the degree of reduction obtained is not considered sufficient to warrant further investigation.

#### IX. RECOMMENDATIONS

The following is a recommended course of action based on the conclusions of this study:

Proceed to implement a program for treatment of the permethrin process wastewater in the Vertac Plant biological treatment system. Nutrient supplements in terms of nitrogen and phosphorus will be required.

Investigate alternate methods of reducing and/or controlling the permethrin content of the permethrin process wastewater. Optimization of the permethrin process operations may be sufficient to eliminate or significantly reduce the extreme concentrations of permethrin experienced during the testing program.

Install the necessary equipment to collect and store the wastewater from each batch of permethrin for evaluation prior to introduction into the Vertac treatment system. If the wastewater is found to be unsatisfactory, alternative disposal arrangements will be required. These may include pretreatment with activated carbon for removal of permethrin and its analogs.



APPENDIX



TABLE 1

This Table is considered and marked CONFIDENTIAL. The information presented in the Table is for the sole use of the Arkansas Department of Pollution Control and Ecology and the Environmental Protection Agency in evaluating the contents of this report. ICI Americas Inc. must grant permission for any other use or dissemination of this information.



TABLE 2  
AQUATIC TOXICITY DATA (LC<sub>50</sub>)

<u>COMPOUND</u>	<u>SOLUBILITY IN WATER @ 20°C</u>	<u>TIME/LC<sub>50</sub>/SPECIES</u>	<u>TIME/LC<sub>50</sub>/SPECIES</u>	<u>TIME/LC<sub>50</sub>/SPECIES</u>	<u>REMARKS</u>
Permethrin Acid Ester	Cis - 3.7ppm Trans - 14.3ppm	24-hr; 6.6ppm Rainbow Trout 48-hr; 6.6ppm Rainbow Trout 96-hr; 6.6ppm Rainbow Trout	96-hr; 3.4ppm Sheepshead Minnow		
Permethrin Acid	Insoluble	24-hr; 11.1ppm Rainbow Trout 48-hr; 9.2ppm Rainbow Trout 96-hr; 3.4ppm Rainbow Trout	24-hr; 200ppm Daphnia Magna 48-hr; 130ppm Daphnia Magna		LC <sub>50</sub> for Daphnia Magna is actually EC <sub>50</sub> .
Permethrin Acid Chloride	Soluble and Decomposes				
3-Phenoxybenzyl Alcohol	595ppm	24-hr; 14.0ppm Rainbow Trout 48-hr; 6.6ppm Rainbow Trout 96-hr; 6.6ppm Rainbow Trout	24-hr; 17ppm Daphnia Magna 48-hr; 10ppm Daphnia Magna		LC <sub>50</sub> for Daphnia Magna is actually EC <sub>50</sub> .

LC<sub>50</sub> = Concentration of toxicant in dilution water that is lethal to exactly 50% of the test organisms during continuous exposure for a specific period of time; this value is termed the Median Lethal Concentration.

EC<sub>50</sub> = Concentration of toxicant in dilution water that causes a defined adverse effect (other than death) in 50% of the test organisms during continuous exposure for a specified period of time; this value is termed the Median Effective Concentration.



<u>COMPOUND</u>	<u>SOLUBILITY IN WATER @ 20°C</u>	<u>TIME/LC<sub>50</sub>/SPECIES</u>	<u>TIME/LC<sub>50</sub>/SPECIES</u>	<u>TIME/LC<sub>50</sub>/SPECIES</u>	<u>REMARKS</u>
Permethrin	0.2-0.3ppm	24-hr; 12.5ppb Rainbow Trout	24-hr; 72ppb Brook Trout	24-hr; 8.6ppb Bluegill Sunfish	
		48-hr; 5.4ppb Rainbow Trout	48-hr; 18.5ppb Brook Trout	48-hr; 1.8ppb Bluegill Sunfish	
		96-hr; 2.5ppb Rainbow Trout	96-hr; 4.7ppb Brook Trout	96-hr; 0.9ppb Bluegill Sunfish	
		24-hr; 6.0ppb Channel Catfish	24-hr; 15ppb Fathead Minnow	24-hr; 98ppb Mirror Carp	
		48-hr; 5.4ppb Channel Catfish	48-hr; 5.4ppb Fathead Minnow	48-hr; 38.5ppb Mirror Carp	
		96-hr; 5.4ppb Channel Catfish	96-hr; 2.0ppb Fathead Minnow	96-hr; 15ppb Mirror Carp	
		24-hr; 2.2ppb Atlantic Salmon	24-hr; 25ppb Coho Salmon	24-hr; 2.1ppb Daphnia Magna	
		48-hr; 1.8ppb Atlantic Salmon	48-hr; 18ppb Coho Salmon	48-hr; 0.6ppb Daphnia Magna	
		96-hr; 1.5ppb Atlantic Salmon	96-hr; 17ppb Coho Salmon		
Toluene	720ppm	24-hr; 24ppm Bluegills	24-hr; 56ppm Fathead Minnows	24-hr; 1340ppm Mosquito Fish	LC <sub>50</sub> for fish is actually TLM. Toxicity threshold for Daphnia occurs at 60 mg/l.
		48-hr; 24ppm Bluegills	48-hr; 56ppm Fathead Minnows	48-hr; 1260ppm Mosquito Fish	
		96-hr; 24ppm Bluegills	96-hr; 42.3ppm Fathead Minnows	96-hr; 1180ppm Mosquito Fish	

LC<sub>50</sub> = Concentration of toxicant in dilution water that is lethal to exactly 50% of the test organisms during continuous exposure for a specific period of time; this value is termed the Median Lethal Concentration.

EC<sub>50</sub> = Concentration of toxicant in dilution water that causes a defined adverse effect (other than death) in 50% of the test organisms during continuous exposure for a specified period of time; this value is termed the Median Effective Concentration.

TLM = Concentration of the substance in question which kills one-half the animals in a specified period of exposure; this value is termed the Median Tolerance Limit. In recent years this term has been replaced by LC<sub>50</sub>.



TABLE 3

This Table is considered and marked CONFIDENTIAL. The information presented in the Table is for the sole use of the Arkansas Department of Pollution Control and Ecology and the Environmental Protection Agency in evaluating the contents of this report. ICI Americas Inc. must grant permission for any other use or dissemination of this information.



### General Process Descriptions for Nitroparaffin Derivatives

Three products will be manufactured which basically use the same raw materials except for a change in the nitroparaffin. The first product, Tris (hydroxymethyl) aminomethane (TA), uses nitromethane; 2-amino-butanol (2AB) uses 1-nitropropane; and 2-amino-2-methyl-propanol (AMP) uses 2-nitropropane.

A nitroparaffin is reacted with formaldehyde followed by water removal. The resulting nitro intermediate is reduced by catalytic hydrogenation. Catalyst is then removed. *heavy metal catalyst*

In the case of TA, product is crystallized from solution, centrifuged, and dried in a rotary, vacuum drier. In 2AB and AMP, products are concentrated by distillation.

Block flowsheets illustrating the above process are attached. Additional detailed process descriptions are given under a separate cover with confidential labeling.

Solvents used in the process will be recovered in the process by distillation and recycle. All major tanks and reactors are vented to a common scrubber capable of removing amines and VOCs from the vent stream. Vent condensers are present on the reactors prior to the scrubber. Tanks not vented to the scrubber are equipped with flame arrestors and conservation vents. All centrifugal pumps have double mechanical seals. Some pumps are canned pumps with no seals.

Material safety data information and specific information on the nitroparaffins is also attached.

May 9, 1989  
J.E. Porter



## PROCESS DESCRIPTIONS

### Tris (hydroxymehtyl) Aminomethane (TA) and Tris (hydroxymehtyl) nitromethane (TN)

A nitroalcohol intermediate is produced by a condensation reaction. The intermediate TN may be removed as product after water removal, and carbon treatment for color removal. To produce TA, TN is hydrogenated followed by ion exchange, carbon treatment, crystallization, centrifugation, and drying.

### 2-Amino-Butanol (2AB)

This amino alcohol is manufactured from 1-nitopropane using most of the same processes as TA, and consequently the same equipment. The exception is the last step of product separation. Instead of crystallization and drying, 2AB is distilled to obtain purity

### 2-Amino-2-methyl-propanol (AMP)

2-Nitopropane is the main raw material for the third product and follows the same manufacturing steps as 2AB.

Ancillary steps in the manufacturing process which generate waste include regeneration of the ion exchange resins, washing of the carbon columns, and solvent recovery. All waste streams from the process will be transported to an appropriate off-site facility for disposal. The wastes will be evaluated for their compatibility with our on-site biological treatment system and will be handled there should it be practical.

There are other products in this series of nitroparaffin derivatives which will be incorporated into this operation at a later date. The general chemistry varies little from these products. The Department will be informed of these products as they are planned for introduction into the manufacturing schedule.



# Grace Project - Nitroparaffin Derivatives

12-May-89

## Physical Properties Chart

J.E. Porter

Note: The following data is for compounds as found in the process; not pure compounds.

Compound	Formula Weight	Boiling Point	Freeze Point	Solubility in Water	Flash Point	Vapor Pressure
<b>TA Process</b>						
Formaldehyde, 44%	30	210 F	NA	Infinite	176 F TCC	3.4 @ 95 F
Methyl Alcohol	32	148 F/65 C	-144 F	Completely Miscible	54 F TCC	138 @ 25 C
Nitromethane	61	214 F/101 C	-20 F/-29 C	9.5 % @ 20 C	95 F/35 C	27.8 @ 20 C
TN	151.1	212 F/100 C		Completely Miscible	ND	24 @ 25 C
NMPD	135.1	149 F/65 C		Completely Miscible	56 F/13 C	MeOH
NMP	119.1	212 F/100 C		Miscible	NA	Water
TA	121.1	NA	340 F/171 C	70 gm/100 gm @ 25 C	NA	NA (solid)
AMPD	105.1	NA	228 F/109 C	250 gm/100 gm @ 20 C	NA	NA (solid)
AMP	89.1	212 F/100 C	NA	Completely Miscible	> 200 F	Water
Triethylamine	101.2	194 F/90 C	-175 F / -115 C	10 % @ 20 C 2 % @ 60 C	20 F TOC	52 @ 20 C



Compound	Formula Weight	Boiling Point	Freeze Point	Solubility in Water	Flash Point	Vapor Pressure
<b>2-AB Process</b>						
Formaldehyde, 44%	30	210 F	NA	Infinite	176 F TCC	3.4 @ 95 F
Methyl Alcohol	32	148 F/65 C	-144 F	Completely Miscible	54 F TCC	138 @ 25 C
1 - Nitropropane	89.1	268 F/131 C	-162 F/108 C	1.4 % @ 20 C	96 F 20 C	7.5 @ 20 C
2- NB	119.1	Water		Miscible	NA	Water
NEPD	149.1	Water		Completely Miscible	NA	Water
NMP	119.1	212 F/100 C		Miscible	NA	Water
2- AB	89.1	352 F/178 C	NA	Completely Miscible	193 F/89 C	7.5 @ 25 C
AEP	119.1	NA	99 F/37 C	Completely Miscible	>200 F	NA
AMP	89.1	212 F/100 C	NA	Completely Miscible	> 200 F	Water
Triethylamine	101.2	194 F/90 C	-175 F / -115 C	10 % @ 20 C 2 % @ 60 C	20 F TOC	52 @ 20 C



Compound	Formula Weight	Boiling Point	Freeze Point	Solubility in Water	Flash Point	Vapor Pressure
<b>AMP Process</b>						
Formaldehyde, 44%	30	210 F	NA	Infinite	176 F TCC	3.4 @ 95 F
Methyl Alcohol	32	148 F/65 C	-144 F	Completely Miscible	54 F TCC	138 @ 25 C
2-Niropropane	89.1	248 F/120 C	-132 F/-91 C	1.7 % @ 20 C	82 F/28 C	12.9 @ 20 C
NMPD	135.1	149 F/65 C		Completely Miscible	56 F/13 C	MeOH
NEPD	149.1	Water		Completely Miscible	NA	Water
NMP	119.1	212 F/100 C		Miscible	NA	Water
AMPD	105.1	NA	228 F/109 C	250 gm/100 gm @ 20 C	NA	NA (solid)
AEP	119.1	NA	99 F/37 C	Completely Miscible	>200 F	NA
AMP	89.1	212 F/100 C	NA	Completely Miscible	> 200 F	Water
Triethylamine	101.2	194 F/90 C	-175 F / -115 C	10 % @ 20 C 2 % @ 60 C	20 F TOC	52 @ 20 C



## Air Permit Calculations/considerations

1. Mono-methylamine (MMA) will be used direct from a sealed, pressurized railcar as anhydrous MMA. A forty (40) percent solution will be made as the first step of the process. Anhydrous MMA will be added to water with the reactor vented to a packed tower, water scrubber. An overhead condenser, and scrubber liquor (water) will be chilled with 40 degree F brine to minimize MMA losses. The scrubber liquor water will be used in the reactor to make subsequent solutions of MMA. MMA is extremely soluble in water.

Projected MMA usage per day:

13,746 lbs. max.	9,164 lbs. average
------------------	--------------------

Assume 0.1% loss to scrubber (potential emissions):

13.75 lbs. max.	9.16 lbs. average
-----------------	-------------------

Assume scrubber loss 0.1% (actual emissions):

0.014 lbs. max.	0.01 lbs. average
-----------------	-------------------

2. Carbon Disulfide (Carbon Bisulfide) will be used direct from a sealed, pressurized railcar. Introduction will be subsurface into a reactor vented to the water scrubber. An overhead condenser and scrubber liquor (water) will be chilled with 40 degree F brine to minimize vapor losses. The scrubber liquor water will become the water charge of the subsequent batch.

Projected usage per day:

33,555 lbs. max.

22,370 lbs. average

Assume 0.1% loss to scrubber (potential emissions):

33.55 lbs. max.

22.37 lbs. average

Assume 0.1% loss from scrubber (actual emissions):

0.03 lbs. max.

0.02 lbs. average



3. Sodium N-methylchithiocarbamate (Metam-Na, Metam-Sodium)  
CAS Registry Number: 137-42-8  
Active Ingredient: 32.7%  
Physical State/Description: Liquid, light yellow color  
Specific Gravity: 1.16 - 1.18 at 68/68 degrees F.  
Boiling Point: 230 degrees F  
Vapor Pressure: 21 mm Hg at 77 degrees F.  
Flash Point: Greater than 200 degrees F. (TCC)  
pH: 9.0 - 10.5

Metam-Na will be transferred from the reactor to intermediate storage tanks. Storage tanks are either vented direct to the scrubber system or have a carbon drum vent to atmosphere. Product will be shipped by railcar.

## Sodium N-methyldithiocarbamate

### Operating Procedure

1. Charge process water to the reactor from the scrubber tank and turn on the agitator.
2. Charge make-up water to the scrubber tank.
3. Check to be sure that the reactor is vented to the water scrubber and that the brine is on the overhead condenser.
4. Use nitrogen pressure to charge the anhydrous monomethyl amine from the railcar to the reactor through the dip pipe. Control the brine flow to the reactor in order to maintain the temperature between 85 and 90 degrees F.
5. Use nitrogen pressure to charge the carbon bisulfide to the reactor. Maintain the reactor temperature between 85 and 90 degrees F by controlling the brine flow to the reactor jacket.
6. Charge 50% caustic to the reactor while maintaining the temperature between 90 and 104 degrees F. Sample the reactor periodically for pH. Adjust the caustic flow in order to maintain the pH below 10.5.
7. When all of the caustic has been added, allow the reactor to mix for 30 minutes and then sample for assay. Adjust the batch if necessary according to lab instructions.
8. When approval is received from the lab, pressure the reactor to 20 psig with nitrogen and transfer the batch to storage.
9. After the product has settled in the storage tank for 24 hours, transfer it to the product railcar through a cartridge filter.



**1988 Production Schedule**

Revised August 1, 1988

Unit	One	Two	Three	Four	Five
January	ICIA	Propanil	SCI		
February	ICIA	Propanil	SCI		
March	ICIA	Propanil	Ortom	Diphone C	
April	ICIA	Propanil	Ortom	Diphone C	
May	ICIA	Propanil			
June	ICIA	Propanil		Diphone C	
July	ICIA	Propanil		Diphone C	
August		Propanil	Metam-Na		
September		Propanil	Metam-Na	Diphone C	
October	ICIA		Ortom	Diphone C	
November	ICIA			Diphone C	
December	ICIA	Propanil			

Projected =



Process: Isonox 132 (2,6-di-tert-butyl phenol)

Basis: Manufactured under toll conversion contract

Raw Materials

para-secondary Butylphenol  
Isobutylene  
Catalyst  
Sodium Carbonate  
Sodium Hydroxide

Process Description

Para-secondary-butylphenol is alkylated with isobutylene in the presence of a catalyst. The acid catalyst is removed with a caustic solution wash and subsequent water wash. The crude product is vacuum distilled to meet purity specifications.

Manufacturing Schedule

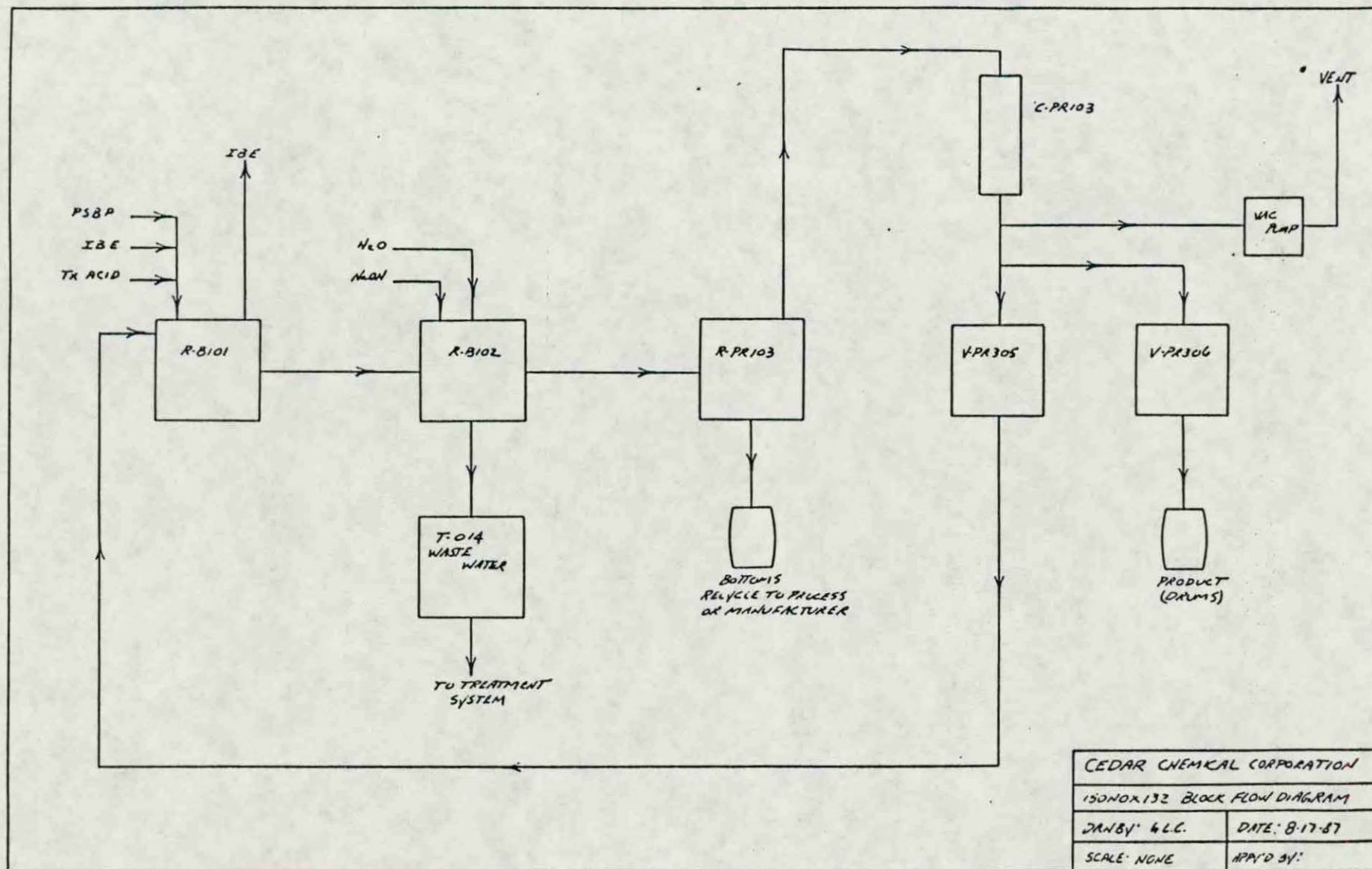
Production is performed approximately four months per year depending on client company demand and availability of equipment. The process utilizes Unit 3 for reactions and a portion of Unit 2 for purification distillation.

Process Considerations

Wastewater generated by washing out the acid catalyst is non-hazardous and is treated in a NPDES permitted, biological treatment system. A distillation forecut and bottoms are recycled until there is an accumulation of an undesirable trimer compound. This is then removed from the process and shipped to an off-site disposal facility.

The process has no direct pollutant air emission. However, the SN-03 vent system is used to disperse hydrogen generated in the process. An undetermined amount of Isobutylene also escapes through the vent system.

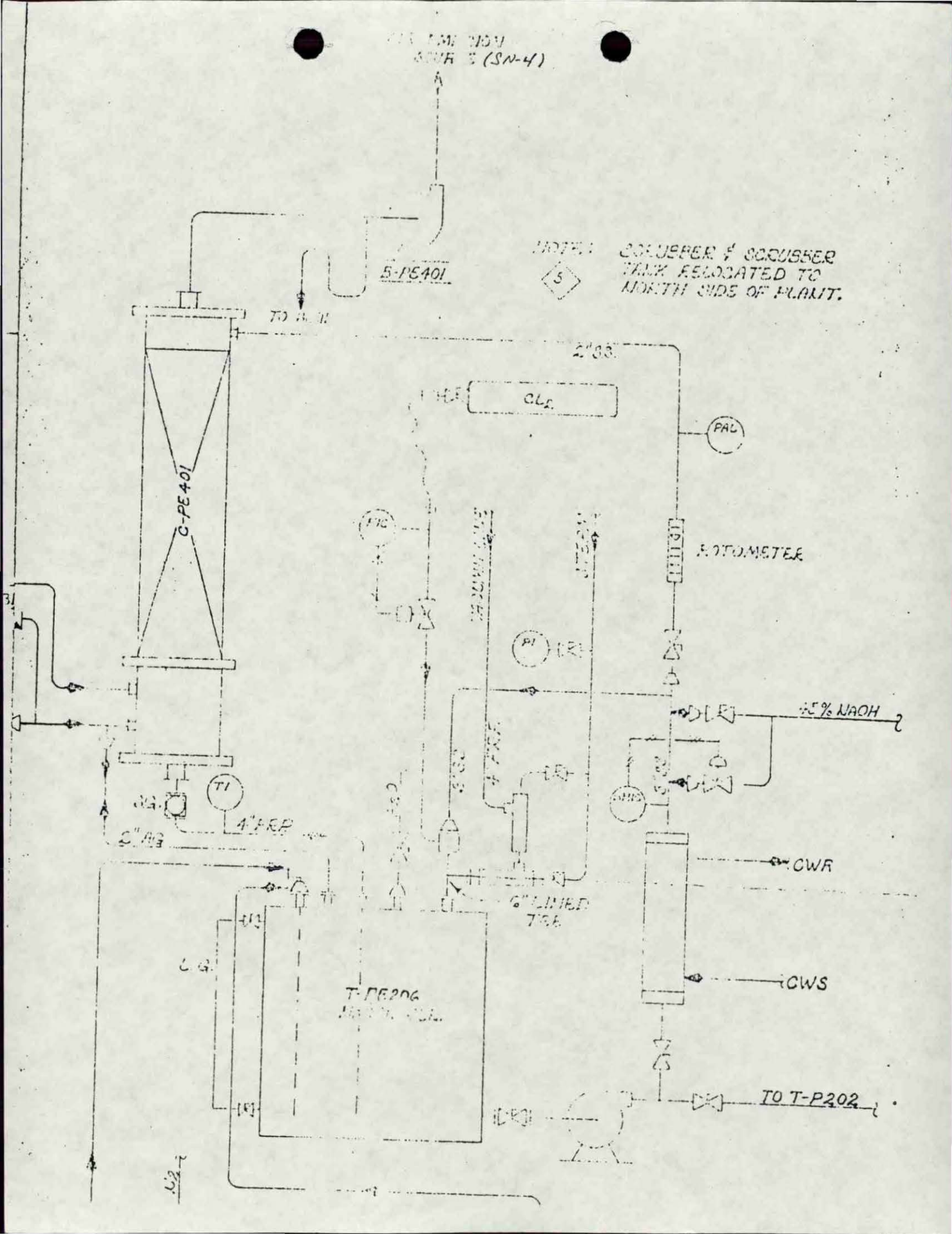




SCI 3 months 1986  
2 months 1987

NEW  
SN-4)

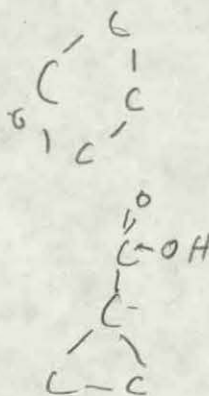
NOTE: 20 UPPER & SCRUBBER  
TANK RELOCATED TO  
NORTH SIDE OF PLANT.





# CYPERMETHRIN

Cypermethrin is the BSI-approved common name for  $\alpha$ -cyano-(3-phenoxyphenyl)methyl(+)cis,trans-3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate. The compound is also known as PP383 and NRDC 149. (The pure trans-isomer is known as NRDC 159 and the pure cis-isomer as NRDC 160.) Cypermethrin is one of several potent insecticidal compounds discovered by Dr. Michael Elliott in Britain and patented by the National Research Development Corporation.



## ENVIRONMENTAL CHEMISTRY

### Degradation in Soil

The degradation of the pyrethroid insecticide cypermethrin and the geometric isomers NRDC 160 (cis-) and NRDC 159 (trans-) in three soils has been studied under laboratory conditions. Samples of the insecticides labelled separately with  $^{14}\text{C}$  in the cyclopropyl and benzyl rings were used. The rate of degradation was most rapid on sandy clay and sandy loam soils, 50% of the NRDC 160 and NRDC 159 applied to both soils being decomposed in 4 weeks and 2 weeks respectively. The major degradative route in all soils was hydrolysis of the ester linkage leading to the formulation of 3-phenoxybenzoic acid and 3-(2,2 dichlorovinyl)-2,2-dimethylcyclopropanecarboxylic acid; soil treated with the cis-isomer (NRDC 160) was found to contain both cis- and trans-isomer forms of the cyclopropanecarboxylic acid. Further degradation of these carboxylic acids was evident since  $^{14}\text{CO}_2$  was released from cyclopropyl- and benzyl-labelled cypermethrin in amounts equivalent to 24 and 38% of the applied radioactivity over a 22-week period. A minor degradative route was ring-hydroxylation of the insecticide to give an  $\alpha$ -cyano-3-(4-hydroxyphenoxy)benzyl ester followed by hydrolysis of the ester bond. Under waterlogged conditions the rate of hydrolysis of cypermethrin on sandy loam soil was slower than under aerobic conditions and 3-phenoxybenzoic acid accumulated in the anaerobic soil.

[Reference: T. E. Roberts and M. E. Standen, Pesticide Science 8 305-319 (1977)]



### Subacute Toxicity

A 90-day feeding study with rats has been conducted. Groups of 20 male and 20 female rats were fed diets containing 0, 75, 150 or 1500 ppm PP383. After ninety days, 16 male and 16 female rats from each group were killed for terminal examination, the remaining animals being maintained on control diet for a four-week recovery period before termination.

Animals given 1500 ppm PP383 showed reduced bodyweight gain and poorer food consumption over the first three weeks but thereafter gained weight and ate as well as controls. The actual bodyweights remained depressed throughout the study (including the recovery period).

There was no effect due to PP383 on blood biochemistry, urinalysis or histopathology of any tissue examined. There was no hematological effect other than a slight increase of the myeloid-erythroid ratio in the bone marrow in female rats on the top dose.

Hepatic changes were shown by proliferation of hepatocyte smooth endoplasmic reticulum and by increased hepatic aminopyrine demethylase activity at 1500 ppm PP383 in males and females, and at 150 ppm in males. These changes were ascribed to the adaptation of the liver to metabolize the compound effectively and were substantially reversed within a four week recovery period. They were considered to be due to a physiological response and not to have any toxicological significance.

It was concluded that PP383 produced only mild or transient effects at a dose of 1500 ppm and that the level of 150 ppm fed over 90 days had no toxicological effect on the rat.

## TOXICOLOGY OF CYPERMETHRIN

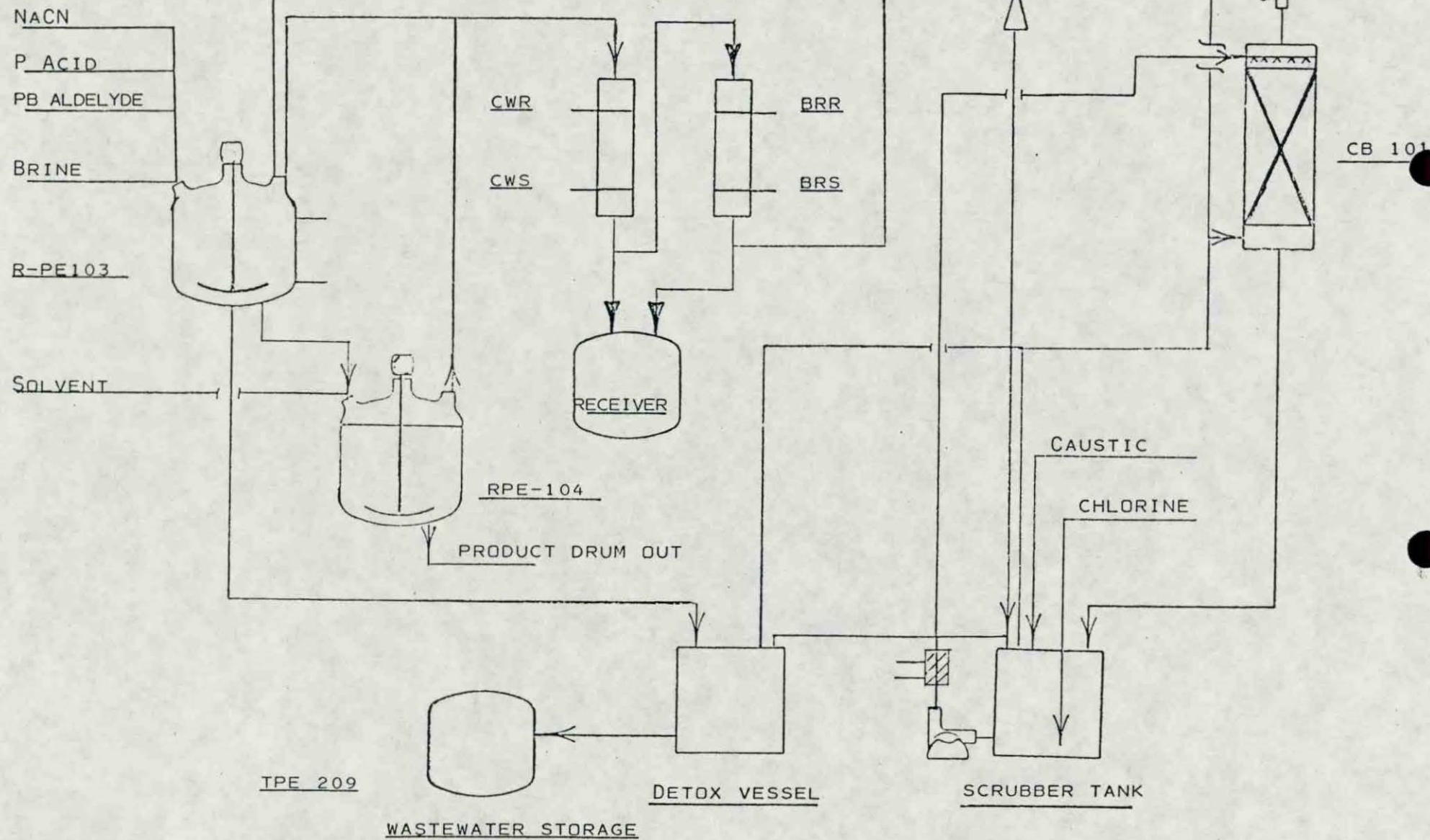
### Acute Toxicity

Cypermethrin is of low toxicity to mammalian species:

Species	Sex	Route of Administration	LD <sub>50</sub> Values mg/kg
Rat	F	Oral	4123 (3496-4864)
Rat	F	Oral	1741 (1502-2019)
Mouse	F	Oral	779 (645-941)
Guinea Pig	M	Oral	>4000
Rabbit	F	Oral	>2400
Rat	F	Dermal	>4800
Rabbit	F	Dermal	>2400
Rat	F	Intraperitoneal	1000-2000
Rat	M	Intraperitoneal	1000-2000

Cypermethrin is practically non-irritant to rat skin and slightly irritant to rabbit skin. The material is a moderate irritant to rabbit eyes and a moderate sensitizer of guinea pig skin.





SOURCE NUMBER	CHEMICAL COMPOSITION OF EMISSION	WEIGHT PERCENT	CONTROL EQUIPMENT TYPE (CYCLONE, ETC.)	COLLECTION EFFICIENCY		INT. DIM. OF DISC. POINT	DISC. HT. ABOVE GROUND	DISCHARGE VELOCITY		DISCHARGE TEMPERATURE	
				MAX	AVG			FT/SEC		DEGREES F.	
SN-				MAX	AVG	FEET	FEET	MAX	AVG	MAX	AVG
1	SULFUR DIOXIDE HCL	0.2% 0.2%	GROUND FLARE	N/A	N/A	2.5	45	60	40	1400	600
2	SULFUR DIOXIDE HCL	0.03% 0.02%	CAUSTIC SCRUBBER	100% 100%	98% 99%	1.0	55	50	40	120	100
3	METHYL MERCAPTAN		HYPOCHLORITE SCRUBBER	100%	99%	1.0	55	60	50	120	
4A	SULFUR DIOXIDE HCL	0.03% 0.01%	CAUSTIC SCRUBBER	99% 100%	98% 99%	1.0	60	20	5	150	100
4B	SULFUR DIOXIDE HCL HYDROGEN CYANIDE	0.03% 0.006% <0.001%	CUASTIC SCRUBBER CAUSTIC SCRUBBER HYPOCHLORITE SCRUBBER	99% 100% 100%	98% 99% 99%	1.0 1.0 1.0	60 60 60	20 20 20	5 5 5	150 150 120	100 100 100
4A=PERMETHRIN 4B=CYPERMETHRIN											



Chemical\_Name: Aqua Ammonia CAS\_Number : Mixture  
Common\_Name : NH4OH  
Physical\_Haza: Corrosive  
PHYS\_Reason :  
Health\_Hazard: Toxic  
Health\_Reason: Eye, Skin, Inhalation, Ingestion

Chemical\_Name: Armul 1287 CAS\_Number : Mixture  
Common\_Name : Propanil Emulsifier  
Physical\_Haza:  
PHYS\_Reason :  
Health\_Hazard:  
Health\_Reason:

Chemical\_Name: Butyl Mercaptan CAS\_Number : 00109-79-5  
Common\_Name : 1-Butanethiol; Thiobutyl Alcohol  
Physical\_Haza: Flammable Liquid  
PHYS\_Reason : FP 38 F  
Health\_Hazard: Nervous System Toxin  
Health\_Reason: Lung Toxin; Skin Hazard

Chemical\_Name: Calcium Oxide CAS\_Number : 01305-78-8  
Common\_Name : Quicklime  
Physical\_Haza: NA  
PHYS\_Reason :  
Health\_Hazard: Irritant  
Health\_Reason: Eye, Inhalation, Ingestion

Chemical\_Name: Carbon Disulfide ~~PO22~~ CAS\_Number : 00075-15-0  
Common\_Name : Carbon Bisulfide  
Physical\_Haza: Flammable Liquid  
PHYS\_Reason : FP -22 F  
Health\_Hazard: Nervous System Toxin  
Health\_Reason: Skin Hazard

Chemical\_Name: Chlorine CAS\_Number : 07782-50-5  
Common\_Name :  
Physical\_Haza: Oxidizer  
PHYS\_Reason :  
Health\_Hazard: Highly Toxic  
Health\_Reason: Eye, Skin, Inhalation, Ingestion

Chemical\_Name: Chlorsanthemic Acid CAS\_Number : Mixture  
Common\_Name : PA; Permethrin Acid  
Physical\_Haza: NA  
PHYS\_Reason : Solvent may be Flammable  
Health\_Hazard: Toxic  
Health\_Reason: Eye, Skin, Ingestion

Chemical\_Name: Cypermethrin Concentrate (70%) CAS\_Number : 52315-07-8  
Common\_Name :  
Physical\_Haza: Combustible Liquid  
PHYS\_Reason : FP 134 F  
Health\_Hazard: Toxic  
Health\_Reason: Ingestion



✓ Chemical\_Name: 2,6-Di-tert-butyl-4-sec-butylphenol CAS\_Number : 17540-75-9  
Common\_Name : Isonox - 132  
Physical\_Haza: Combustible Liquid  
PHYS\_Reason : FP 200 F  
Health\_Hazard: Irritant  
Health\_Reason: Skin, Ingestion

✓ Chemical\_Name: 3,4-Dichloroaniline CAS\_Number : 00095-76-1  
Common\_Name : DCA; Benzeneamine, 3,4-Dichloro; 1-Amino  
Physical\_Haza: NA  
PHYS\_Reason : *insoluble in water*  
Health\_Hazard: Toxic *very soluble in alcohol*  
Health\_Reason: *slightly soluble in benzene*

✓ Chemical\_Name: 3,4-Dichloropropionanilide CAS\_Number : 00709-98-8  
Common\_Name : Stam M-4 HF Herbicide; Propanil-4  
Physical\_Haza: Combustible Liquid *4-Cl-CH<sub>2</sub>-CH<sub>2</sub>*  
PHYS\_Reason : FP108 F *staminate*  
Health\_Hazard: Toxic *residue*  
Health\_Reason: Inhalation *chem rice*  
*sol = 225 ppm at 70°F*  
*LD50 rats = 1384 mg/kg*

✓ Chemical\_Name: 3,4-Dichloropropionanilide, Technical CAS\_Number : 00709-98-8  
Common\_Name : Propanil, Technical  
Physical\_Haza: NA  
PHYS\_Reason :  
Health\_Hazard: Toxic  
Health\_Reason: Ingestion

✓ Chemical\_Name: 3-(hydroxymethyl) diphenyl ether CAS\_Number : 13826-35-2  
Common\_Name : PBA; Phenoxy Benzyl Alcohol  
Physical\_Haza: NA  
PHYS\_Reason :  
Health\_Hazard: Irritant  
Health\_Reason: Eye, Skin, Inhalation, Ingestion

✓ Chemical\_Name: Allyl Chloride 287 *fp -45°* CAS\_Number : 00107-05-1  
Common\_Name : 3-Chloro-1-propene *slightly sol in water*  
Physical\_Haza: Flammable Liquid *IP*  
PHYS\_Reason : FP (-25) F *N=0*  
Health\_Hazard: Highly Toxic *NO<sub>2</sub>*  
Health\_Reason: *LD50 = 0.7 g/kg*

Chemical\_Name: Allyl n-butyl Trithiocarbonate CAS\_Number :  
Common\_Name : ORFOM CO 300  
Physical\_Haza: Combustible Liquid  
PHYS\_Reason : FP 135 F  
Health\_Hazard: Irritant  
Health\_Reason:

Chemical\_Name: Anhydrous Ammonia CAS\_Number : 07664-41-7  
Common\_Name : Ammonia  
Physical\_Haza: Compressed Gas  
PHYS\_Reason :  
Health\_Hazard: Toxic  
Health\_Reason: Eye, Skin, Inhalation



Chemical\_Name: Cypermethrin Process Wastewater CAS\_Number : Mixture  
Common\_Name : See Toluene  
Physical\_Haza: Flammable Liquid *INSOL in water*  
PHYS\_Reason : FP 80 F  
Health\_Hazard: Irritant  
Health\_Reason: Eye, Skin, Inhalation

Chemical\_Name: Dimethylformamide CAS\_Number : 00068-12-2  
Common\_Name : DMF  
Physical\_Haza: Combustible Liquid *H-C-O-N-CH<sub>3</sub> slightly yellow liquid*  
PHYS\_Reason : FP 136 F  
Health\_Hazard: Irritant  
Health\_Reason: Eye, Skin, Inhalation, Ingestion *CH<sub>3</sub> Misc in water universal solvent*

Chemical\_Name: Dinitro-O-Cresol in Styrene CAS\_Number : Mixture  
Common\_Name : DNOC in Styrene; DNOC; Styrene  
Physical\_Haza: Flammable Liquid  
PHYS\_Reason :  
Health\_Hazard: Highly Toxic  
Health\_Reason: Skin, Inhalation, Ingestion

Chemical\_Name: Ethyl Chloride CAS\_Number : 00075-00-3  
Common\_Name : Monochloroethane *ethyl*  
Physical\_Haza: Flammable Liquid  
PHYS\_Reason : FP (-45) F *0.574 g/100 sol*  
Health\_Hazard: Acute intoxication; frost *high V.P.*  
Health\_Reason: Chronic hazard unknown

Chemical\_Name: Flomo Stam 1671 CAS\_Number : Mixture  
Common\_Name : Stam Emulsifier  
Physical\_Haza: Combustible Liquid  
PHYS\_Reason : FP 102  
Health\_Hazard: Irritant  
Health\_Reason: Eye, Skin, Inhalation, Ingestion

Chemical\_Name: Hydrochloric Acid CAS\_Number : 07647-01-0  
Common\_Name : HCL; Muriatic Acid  
Physical\_Haza: Corrosive  
PHYS\_Reason :  
Health\_Hazard: Highly Toxic  
Health\_Reason: Skin

Chemical\_Name: Isobutylene CAS\_Number : 00115-11-7  
Common\_Name : 2-Methylpropene  
Physical\_Haza: Compressed Gas  
PHYS\_Reason : FP (-112) F  
Health\_Hazard: Irritant  
Health\_Reason: Skin

Chemical\_Name: Isophorone CAS\_Number : 00078-59-1  
Common\_Name : Isoacetophorone; 3,5,5-trimethyl-2-cyclopropane carbox  
Physical\_Haza: Combustible Liquid  
PHYS\_Reason : FP 179  
Health\_Hazard: Irritant  
Health\_Reason: Eye, Inhalation



✓ Chemical\_Name: M-Phenoxybenzaldehyde CAS\_Number : 39515-51-0  
Common\_Name : PBA; 3-Phenoxybenzaldehyde  
Physical\_Haza: NA  
YS\_Reason :  
Health\_Hazard: Irritant  
Health\_Reason: Eye, Skin, Ingestion

Chemical\_Name: Methyl 3-(2,2-dichloroethenyl) CAS\_Number : 61898-95-1  
Common\_Name : FAM; DV Methyl Ester  
Physical\_Haza: Combustible Liquid  
PHYS\_Reason :  
Health\_Hazard: Irritant  
Health\_Reason: Eye, Inhalation

✓ Chemical\_Name: Methyl Alcohol CAS\_Number : 00067-56-1  
Common\_Name : Methanol, MeOH  
Physical\_Haza: Flammable Liquid  
PHYS\_Reason : FP 54 F  
Health\_Hazard: Irritant  
Health\_Reason: Eye, Skin, Inhalation, Ingestion

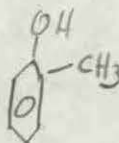
Chemical\_Name: Methyl Ethyl Sulfide CAS\_Number : 00624-89-5  
Common\_Name : MES  
Physical\_Haza: Flammable Liquid  
PHYS\_Reason : FP (<0) F est  
Health\_Hazard: Target Organ Toxic  
Health\_Reason: Eyes and Skin inflammation, lung

Chemical\_Name: Methyl Isobutyl Ketone CAS\_Number : 00188-10-1  
Common\_Name : MIBK; 4-methyl-2-Pentanone  
Physical\_Haza: Flammable Liquid  
PHYS\_Reason : FP 60 F  
Health\_Hazard: Toxic  
Health\_Reason: Lung

✓ Chemical\_Name: Methyl Mercaptan CAS\_Number : 00074-93-1  
Common\_Name : Methanethiol; Mercaptanmethane; MESH  
Physical\_Haza: Compressed Gas; NFPA 2-4-  
PHYS\_Reason : Flammable  
Health\_Hazard: Irritant  
Health\_Reason:

✓ Chemical\_Name: Nitric Acid CAS\_Number : 07697-37-2  
Common\_Name : HNO3  
Physical\_Haza: Corrosive  
PHYS\_Reason :  
Health\_Hazard: Toxic  
Health\_Reason: Skin, Inhalation, Ingestion

✓ Chemical\_Name: Ortho-Cresol CAS\_Number : 00095-48-7  
Common\_Name : 2-Methyl Phenol  
Physical\_Haza: Corrosive  
PHYS\_Reason : Combustible Liquid  
Health\_Hazard: Highly Toxic  
Health\_Reason: Skin, Inhalation, Ingestion





Chemical\_Name: para-secondary Butylphenol

CAS\_Number : 00099-71-8

Common\_Name : PSBP

Physical\_Haza: NA

PHYS\_Reason :

Health\_Hazard: Irritant

Health\_Reason: Eye, Skin

Chemical\_Name: Permethrin Acid Chloride

CAS\_Number : Mixture

Common\_Name : PACL

Physical\_Haza: NA

PHYS\_Reason : Solvent may be Flammable

Health\_Hazard: Irritant

Health\_Reason: Corrosive Properties

Chemical\_Name: Permethrin Process Wastewater

CAS\_Number : Mixture

Common\_Name : See Toluene; See Tenneco 500/100

Physical\_Haza: Flammable Liquid

PHYS\_Reason : FP 45 F

Health\_Hazard: Toxic

Health\_Reason: Eye, Skin, Ingestion

Chemical\_Name: Permethrin, Technical

CAS\_Number : 52645-51-1

Common\_Name :

Physical\_Haza: NA

PHYS\_Reason :

Health\_Hazard: Irritant

Health\_Reason: Eye, skin, Ingestion

Chemical\_Name: Propionic Acid

CAS\_Number : 00079-09-4

Common\_Name : Propanoic acid; Pot acid; Methyl Acetic Acid

Physical\_Haza: Corrosive

PHYS\_Reason : Also Combustible FP 126 F

Health\_Hazard: Toxic

Health\_Reason: Skin

Chemical\_Name: Propionic Anhydride

CAS\_Number : 00023-62-6

Common\_Name : Anhydride; Propionyl Oxide; Methyl Acetic Anhydride

Physical\_Haza: Corrosive

PHYS\_Reason : FP 145 F

Health\_Hazard: Highly Toxic

Health\_Reason:

Chemical\_Name: Sodium Carbonate

CAS\_Number : 00497-19-8

Common\_Name : Soda Ash

Physical\_Haza: NA

PHYS\_Reason :

Health\_Hazard: Irritant

Health\_Reason: Eye, Skin, Ingestion, Inhalation

Chemical\_Name: Sodium Chloride

CAS\_Number : 07647-14-5

Common\_Name : Salt

Physical\_Haza: NA

PHYS\_Reason :

Health\_Hazard: NA

Health\_Reason:

✓ Chemical\_Name: Sodium Cyanide CAS\_Number : 00143-33-9  
Common\_Name : Cyanide  
Physical\_Haza: Corrosive  
/S\_Reason :  
Health\_Hazard: Highly Toxic  
Health\_Reason: Eye, Skin, Inhalation, Ingestion

✓ Chemical\_Name: Sodium Hydroxide CAS\_Number : 01310-73-2  
Common\_Name : NaOH; Caustic Soda, Liquid  
Physical\_Haza: Corrosive  
PHYS\_Reason :  
Health\_Hazard: Highly Toxic  
Health\_Reason: Eye, Skin, Ingestion

✓ Chemical\_Name: Sodium Hypochlorite Solution CAS\_Number : 07681-52-9  
Common\_Name : Hypo; Bleach  
Physical\_Haza: NA  
PHYS\_Reason :  
Health\_Hazard: Irritant  
Health\_Reason: Eye, Skin, Inhalation, Ingestion

✓ Chemical\_Name: Styrene CAS\_Number : 00100-42-5  
Common\_Name : Vinyl Benzene  
Physical\_Haza: Flammable Liquid  
PHYS\_Reason : FP 88 F  
Health\_Hazard: Toxic  
Health\_Reason: Inhalation, Ingestion

✓ Chemical\_Name: Tenneco 500/100 CAS\_Number : 25551-13-7  
Common\_Name : Xylenes, Mixed  
Physical\_Haza: Flammable Liquid  
PHYS\_Reason : FP 100 F  
Health\_Hazard: Toxic  
Health\_Reason:

Chemical\_Name: Tetraethyl Ammonium Bromide CAS\_Number : 00071-91-0  
Common\_Name : TEAB; Quaternary Ammonium Salt  
Physical\_Haza: NA  
PHYS\_Reason :  
Health\_Hazard: Irritant  
Health\_Reason: Skin, Ingestion

✓ Chemical\_Name: Thionyl Chloride CAS\_Number : 07719-09-7  
Common\_Name : Sulfur oxychloride; Sulfurous oxychloride  
Physical\_Haza: Water Reactive  
PHYS\_Reason : Forms SO2 and HCl  
Health\_Hazard: Corrosive  
Health\_Reason: Eye, Skin, Inhalation

✓ Chemical\_Name: Toluene CAS\_Number : 00108-88-3  
Common\_Name : Toluol; Methyl Benzene  
Physical\_Haza: Flammable Liquid  
PHYS\_Reason : FP 45 F  
Health\_Hazard: Irritant  
Health\_Reason: Inhalation



✓ Chemical\_Name: Toximul 804

CAS\_Number : Mixture

Common\_Name : Propanil Emulsifier

Physical\_Haza: Combustible Liquid

YS\_Reason : FP 140 F

Health\_Hazard: Irritant

Health\_Reason: Eye, skin, Inhalation, Ingestion

Chemical\_Name: Ultra TX Acid

CAS\_Number : 00104-15-4

Common\_Name : Toluene &amp; Xylene Sulfonic Acid, Mixture

Physical\_Haza: NA

PHYS\_Reason :

Health\_Hazard: Irritant

Health\_Reason: Eye, Skin, Inhalation, Ingestion

Chemical\_Name: Xylene

CAS\_Number : 01330-20-7

Common\_Name : Xylol; methyl toluene; Dimethyl Benzene

Physical\_Haza: Flammable Liquid

PHYS\_Reason : FP 79 F

Health\_Hazard: Toxic

Health\_Reason: Eye, Skin, Inhalation, Ingestion

Should expect  
to find 3p  
phenoxy benzoic  
in saturated  
soils - aquifer

hydroxy acid  
HCP  
hydroxy benzoic acid  
HCPs

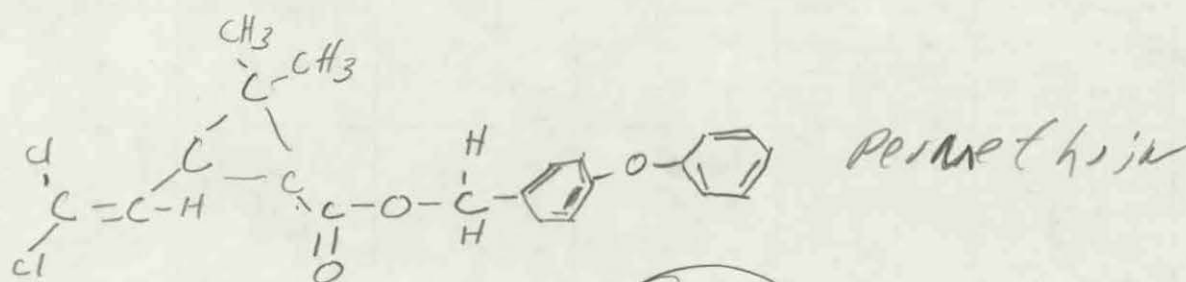
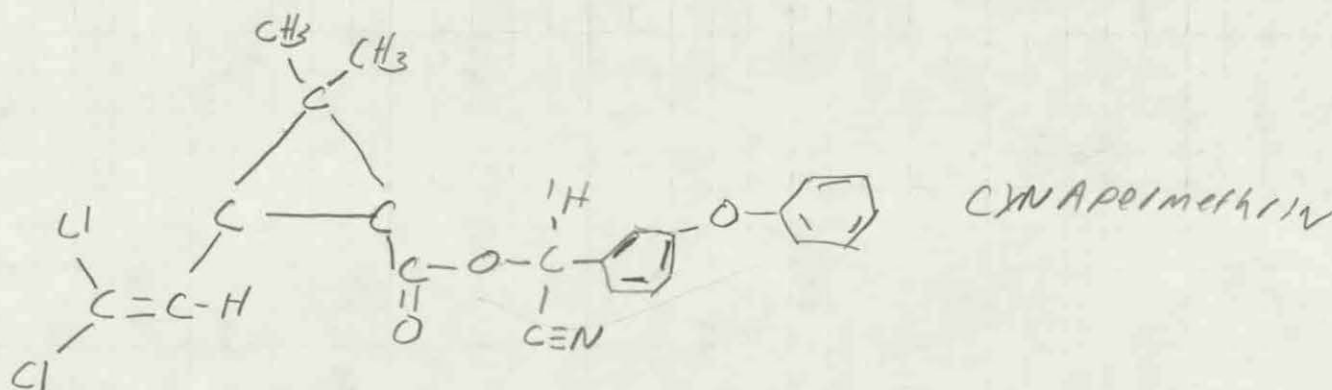


STATE OF ARKANSAS  
DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY

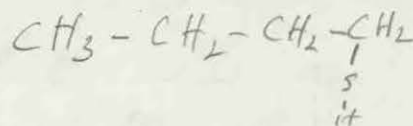
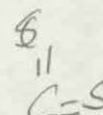
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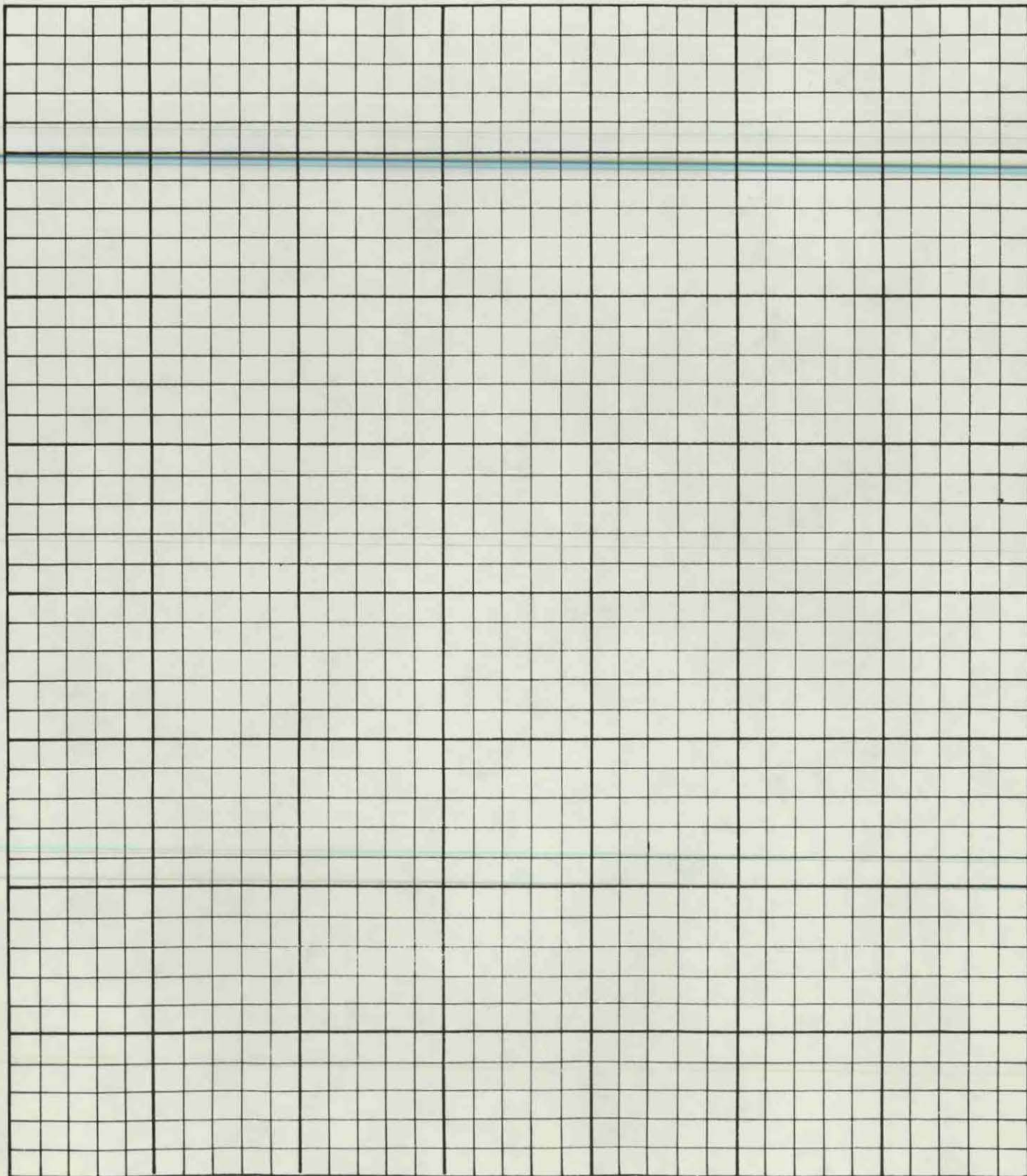
PROJECT \_\_\_\_\_



3 p







### Process Description

A feed blend is prepared by dissolving a polybutadiene in a solution of Dicyclopentadiene (DCPD) and Ethylidenenorborne (ENB). The solution is dried by vacuum distilling a small portion overhead. The resulting dried solution is then divided into two portions and transferred to reactors R-3 and R-4 for formulation.

Each reactor (R-3 and R-4) then has specific additives changed with the additives being different for each reactor. Amounts added are small and very critical as to weight and order of addition. When mixing is complete, the contents of each reactor is drummed using colored codes for each reactor.

The project utilizes existing equipment from Unit 1: R-PE107, R-PE103, and R-PE104. One of the existing scrubber systems will be used with a scrubbing medium of Kerosene. A mill to chop the polybutadiene into smaller pieces for dissolving in DCPD is the only piece of hardware to be added.

DCPD will be used from a tank truck for the trial run in June with all other raw materials arriving in drums or other small containers. Future production runs will require DCPD in tank truck or rail car quantities. There are no storage tanks being assigned to this project for any raw material or product.



### Environmental Consideration

A trial batch to test commercial quantities of the Telene products is scheduled for June. The trial will consist of one batch and is estimated to require three days of operation. Based upon the quality of product produced in the trial run, initial commercial runs are planned for October. The production period will require approximately 20 days to complete. Additional commercial campaigns in 1991 might require as much as 100 total days with two production cycles during the year.

For the trial batch and initial run, we have calculated only the emissions due to DCPD and off-gas ethane. The formulation ingredients are small quantities and do not impact the overall emission of VOC compounds.

### Scrubber System

An existing scrubber, C-PE101, will absorb emissions from the three reactors, receivers, and vacuum pump. Kerosene is used as the scrubbing medium. Due to the solubility of DCPD in Kerosene, we have assumed a 95% efficiency factor to the scrubber system. This does not count heat exchanger recover.

#### Estimated Emissions

Trial Batch  
1990 Total  
1991 Total

#### DCPD

0.47 lbs  
6.26 lbs  
23.16 lbs

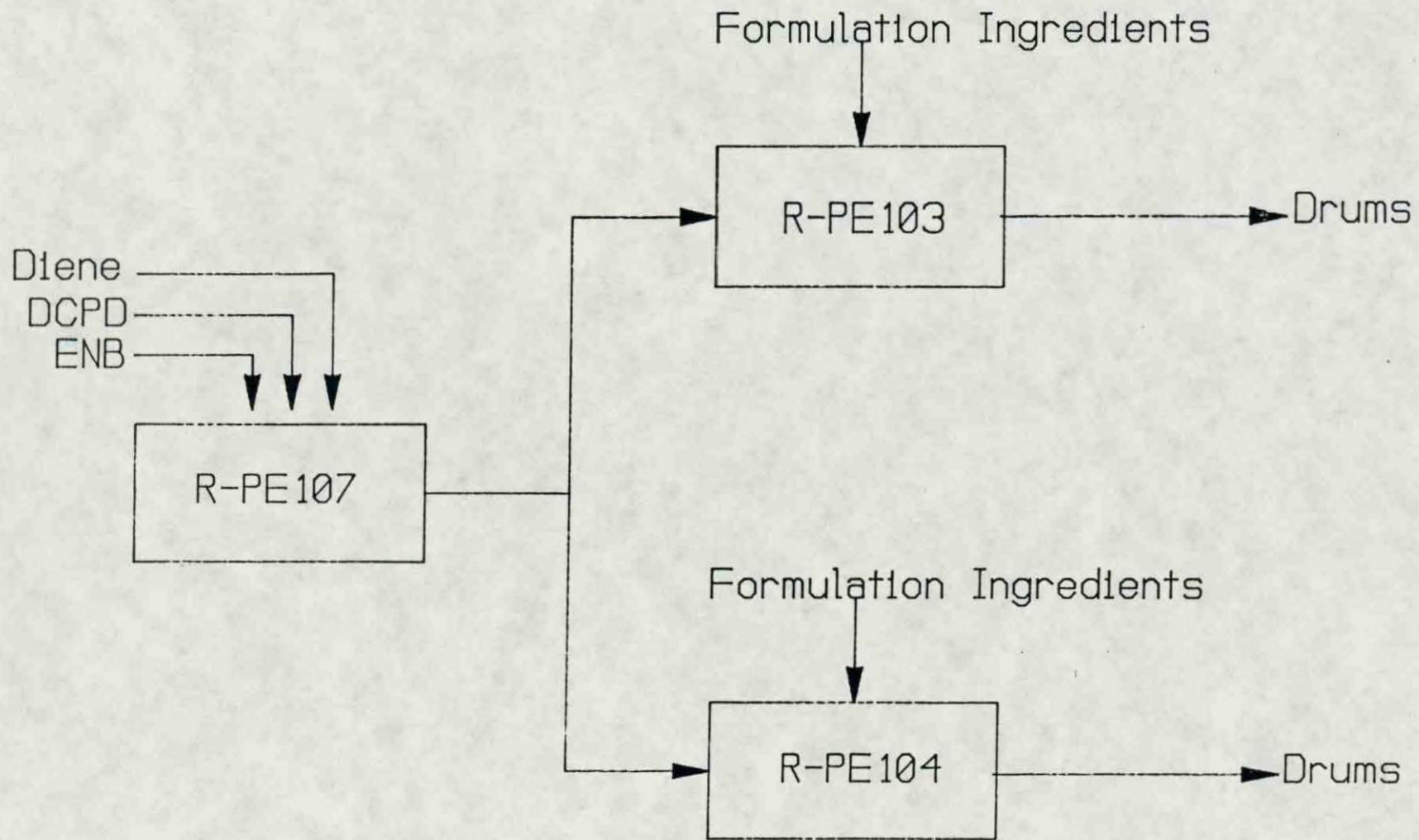
#### Ethane

15.6 lbs  $\times \frac{29}{19}$   
207.7 lbs  $\times \frac{29}{19}$   
768.5 lbs  $\times \frac{29}{19}$

$C_2H_6 = 29$  not 19

CEDAR Chemical Corporation

B F Goodrich Telene(R) Project





## Du Pont Material Safety Data Sheet

## MATERIAL IDENTIFICATION

NUMBER : 1076CR  
NAME : 2-Chloro-4-Nitrotoluene  
  
GRADE : Technical  
CHEMICAL FAMILY : Aromatic  
TRADE NAMES AND SYNONYMS :  
p-Nitro-o-chlorotoluene  
  
CAS NAME : Benzene, 2-chloro-1-methyl-4-nitro  
CAS NUMBER : 121-86-8  
FORMULA : ClC6H3(NO2)CH3  
TSCA INVENTORY STATUS : Reported/Included  
NPCA-HMIS RATING : Health: 2 Flammability: 1 Reactivity: 0  
Personal Protection rating to be supplied by  
user depending on use conditions.  
MANUFACTURER/DISTRIBUTOR: E.I. du Pont de Nemours & Co., Inc.  
1007 Market Street  
Wilmington, DE 19898  
PRODUCT INFORMATION PHONE : 1-(800)441-7515  
TRANSPORTATION EMERGENCY PHONE : 1-(800)424-9300  
MEDICAL EMERGENCY PHONE : 1-(800)441-3637

\*\*\*\*\*  
COMPONENTS

Material	CAS Number	%
2-Chloro-4-Nitrotoluene	121-86-8	93
2,6-Dichloro-4-Nitrotoluene	7149-69-1	4
p-Nitrotoluene	99-99-0	3

\*\*\*\*\*  
PHYSICAL DATA

Boiling Point : 260 deg C at 760 mm Hg. (500 F)  
Melting Point : 57 to 60 deg C 135-140 F  
Evaporation Rate : <1  
Solubility in Water : 0.17 WT % at 20 deg C  
Odor : Sweet, pungent  
Form : Crystalline  
Color : Medium to dark brown  
Specific Gravity : 1.27 at 70 deg C  
Vapor Pressure: 0.016 mmHg @ 25 C (77 F)  
0.044 mmHg @ 38 C (100 F)  
Vapor Density: Not determined  
pH Information: 7.3 (water extract)

## HAZARDOUS REACTIVITY

Instability : Stable at normal temperatures and conditions of storage.

Incompatibility : None reasonably foreseeable.

Polymerization : Polymerization will not occur.

Decomposition: Will occur at temperatures above 260 C (500 F), releasing hazardous nitrogen oxide and hydrochloric acid gases. Acidic conditions, and/or contamination by foreign materials, will substantially lower this decomposition temperature.

\*\*\*\*\*  
FIRE AND EXPLOSION DATA

Flash Point : 133 deg C

Method : SFCC

Flammable Limits in Air, % by Vol.

LEL : Not available.

UEL : Not available.

Autoignition Temperature : Not available.

Autodecomposition Temp: >260 C (see "Decomposition")

## FIRE AND EXPLOSION HAZARDS

OSHA Class III B Combustible material.

## EXTINGUISHING MEDIA

Small fires: Dry chemical, carbon dioxide (CO2)

Large fires: Water spray, fog, or foam

## SPECIAL FIRE FIGHTING INSTRUCTIONS

Evacuate personnel to a safe area. Keep personnel removed & upwind of fire. Wear self-contained breathing apparatus. Cool tank/container with water spray.

Use caution approaching an advanced or massive fire.

Product may decompose at high temperatures and rupture container.

\*\*\*\*\*  
HEALTH HAZARD INFORMATION

Harmful if inhaled or absorbed through skin; reduces blood's oxygen carrying capacity. Symptoms may be delayed. Causes skin and eye irritation.

Oral LD50: 1499 mg/kg in rats



## (HEALTH HAZARD INFORMATION - CONTINUED)

The compound is an eye irritant and is a slight skin irritant.

Human health effects of overexposure may initially include: reduction of the blood's oxygen carrying capacity with cyanosis (bluish discoloration), weakness, or shortness of breath by formation of methemoglobin; abnormal blood forming system function with anemia; or red blood cell destruction. Skin permeation can occur in amounts capable of producing the effects of systemic toxicity. There are no reports of human sensitization. Individuals with preexisting diseases of the cardiovascular system or bone marrow may have increased susceptibility to the toxicity of excessive exposures.

## Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

## Exposure Limits for 2-Chloro-4-Nitrotoluene

TLV \*\* (ACGIH) : None Established  
PEL (OSHA) : None Established

## Other Applicable Exposure Limits:

## Exposure Limits for p-Nitrotoluene

AEL \* (DuPont): None Established  
TLV \*\* (ACGIH) : 2 ppm, 11 mg/m<sup>3</sup>, skin  
PEL (OSHA) : 5 ppm, 30 mg/m<sup>3</sup>, skin

\* AEL is DuPont's Acceptable Exposure Limit.

\*\* TLV is a registered trademark.

## Safety Precautions

Avoid breathing vapors or mist. Avoid contact with eyes. Avoid contact with skin. Avoid contact with clothing. Avoid breathing dust. Wash thoroughly after handling.

\*\*\*\*\*  
FIRST AID

If inhaled: Remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

In case of contact: Immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash



(FIRST AID - CONTINUED)

clothing before reuse and destroy contaminated shoes.

If swallowed: Induce vomiting immediately by giving 2 glasses of water and sticking finger down throat. Call a physician. Never give anything by mouth to an unconscious person.

Note to Physician: Absorption of this product into the body leads to the formation of methemoglobin which, in sufficient concentration, causes cyanosis. In case of skin absorption, symptoms may be delayed. Since reversion of methemoglobin to hemoglobin occurs spontaneously after termination of exposure, moderate degrees of cyanosis need be treated only by supportive measures such as bed rest and oxygen inhalation. Thorough cleansing of the entire contaminated area of the body including scalp and nails is of utmost importance. If cyanosis is severe, intravenous injection of methylene blue, 1 mg/kg body weight, may be of value. Cyanocobalamin (Vitamin B-12), 1 mg intramuscularly, will speed recovery. Intravenous fluids and blood transfusions may be indicated in very severe exposures.

\*\*\*\*\*  
PROTECTION INFORMATION

## Generally Applicable Control Measures and Procedures

Good general ventilation should be provided to minimize personal contact.

### Personal Protective Equipment

Eye/Face : Coverall chemical splash goggles. Safety  
glassed (side shields); full-length face shield

Respirator : (w/chemical-proof suit w/hood) if direct  
exposure is likely.

Additional : Protective footwear. Pants, jacket, and apron

Protective Gloves : Butyl rubber gauntlet gloves

\*\*\*\*\*  
DISPOSAL INFORMATION

## Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.

Evacuate area and keep upwind of spill. Contain spill with sand or earth dam. Allow to freeze or soak up with sand or earth and transfer to a covered metal container for disposal. Flush area with detergent and water. Comply with Federal, State, and local regulations on reporting releases.



## (DISPOSAL INFORMATION - CONTINUED)

## Waste Disposal

Comply w/Fed., State & local reg. If approved may be incinerated, sent to an approved hazardous material disposal area, or transferred to a licensed disposal contractor. Dilute solutions are biodegradeable by specially acclimated bacteria.

\*\*\*\*\*  
SHIPPING INFORMATION

## DOT

Proper Shipping Name :  
RQ Hazardous Substance\*, Liquid, N.O.S. (contains  
p-Nitrotoluene)  
Hazard Class : ORM-E  
UN/NA No. : 9188

## DOT/IMO

Proper Shipping Name :  
Poisonous Solid, N.O.S. (2-Chloro-4-Nitrotoluene)  
Hazard Class : Poison B, 6.1  
UN No. : 2811  
Special Information : IMO Label: Harmful - stow away from food  
stuffs

## Shipping Containers

Tank cars, tank trucks  
REPORTABLE QUANTITY 1000 lb/454 kg

\*\*\*\*\*  
STORAGE CONDITIONS

Store in well ventilated area. Keep container tightly closed.  
Store away from heat, sparks, and flame. Handle in a  
manner to prevent human contact.

\*\*\*\*\*  
ADDITIONAL INFORMATION AND REFERENCES

\*Regulated as a hazardous material by DOT only when shipped  
in containers in excess of 1000 pounds each.

## Title III Classifications:

Acute Health - Yes  
Chronic Health - Yes  
Fire Hazard - No  
Reactivity - No  
Pressure - No

For further information, see Du Pont "2-Chloro-4-Nitrotoluene, Technical" Data Sheet.

28-Apr-89

Du Pont Material Safety Data Sheet

Page 6

MSDS No: 1076CR

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Date of latest Revision : 88/02/11  
Responsibility for MSDS : J. C. Watts  
Du Pont Co., C&P Dept.  
Chestnut Run, Bldg. 709  
Wilmington, DE 19898  
302-999-4946



## Grace Project - Nitroparaffin Derivatives

12-May-89

## Physical Properties Chart

J.E. Porter

Note: The following data is for compounds as found in the process; not pure compounds.

Compound	Formula Weight	Boiling Point	Freeze Point	Solubility in Water	Flash Point	Vapor Pressure
<b>TA Process</b>						
Formaldehyde, 44%	30	210 F	NA	Infinite	176 F TCC	3.4 @ 95 F
Methyl Alcohol	32	148 F/65 C	-144 F	Completely Miscible	54 F TCC	138 @ 25 C
Nitromethane	61	214 F/101 C	-20 F/-29 C	9.5 % @ 20 C	95 F/35 C	27.8 @ 20 C
TN	151.1	212 F/100 C		Completely Miscible	ND	24 @ 25 C
NMPD	135.1	149 F/65 C		Completely Miscible	56 F/13 C	MeOH
NMP	119.1	212 F/100 C		Miscible	NA	Water
TA	121.1	NA	340 F/171 C	70 gm/100 gm @ 25 C	NA	NA (solid)
AMPD	105.1	NA	228 F/109 C	250 gm/100 gm @ 20 C	NA	NA (solid)
AMP	89.1	212 F/100 C	NA	Completely Miscible	> 200 F	Water
Triethylamine	101.2	194 F/90 C	-175 F / -115 C	10 % @ 20 C 2 % @ 60 C	20 F TCC	52 @ 20 C

Compound	Formula Weight	Boiling Point	Freeze Point	Solubility in Water	Flash Point	Vapor Pressure
<b>2-AB Process</b>						
Formaldehyde, 44%	30	210 F	NA	Infinite	176 F TCC	3.4 @ 95 F
Methyl Alcohol	32	148 F/65 C	-144 F	Completely Miscible	54 F TCC	138 @ 25 C
1 - Nitropropane	89.1	268 F/131 C	-162 F/108 C	1.4 % @ 20 C	96 F 20 C	7.5 @ 20 C
2- NB	119.1	Water		Miscible	NA	Water
NEPD	149.1	Water		Completely Miscible	NA	Water
NMP	119.1	212 F/100 C		Miscible	NA	Water
2- AB	89.1	352 F/178 C	NA	Completely Miscible	193 F/89 C	7.5 @ 25 C
AEP	119.1	NA	99 F/37 C	Completely Miscible	>200 F	NA
AMP	89.1	212 F/100 C	NA	Completely Miscible	> 200 F	Water
Triethylamine	101.2	194 F/90 C	-175 F / -115 C	10 % @ 20 C 2 % @ 60 C	20 F TCC	52 @ 20 C

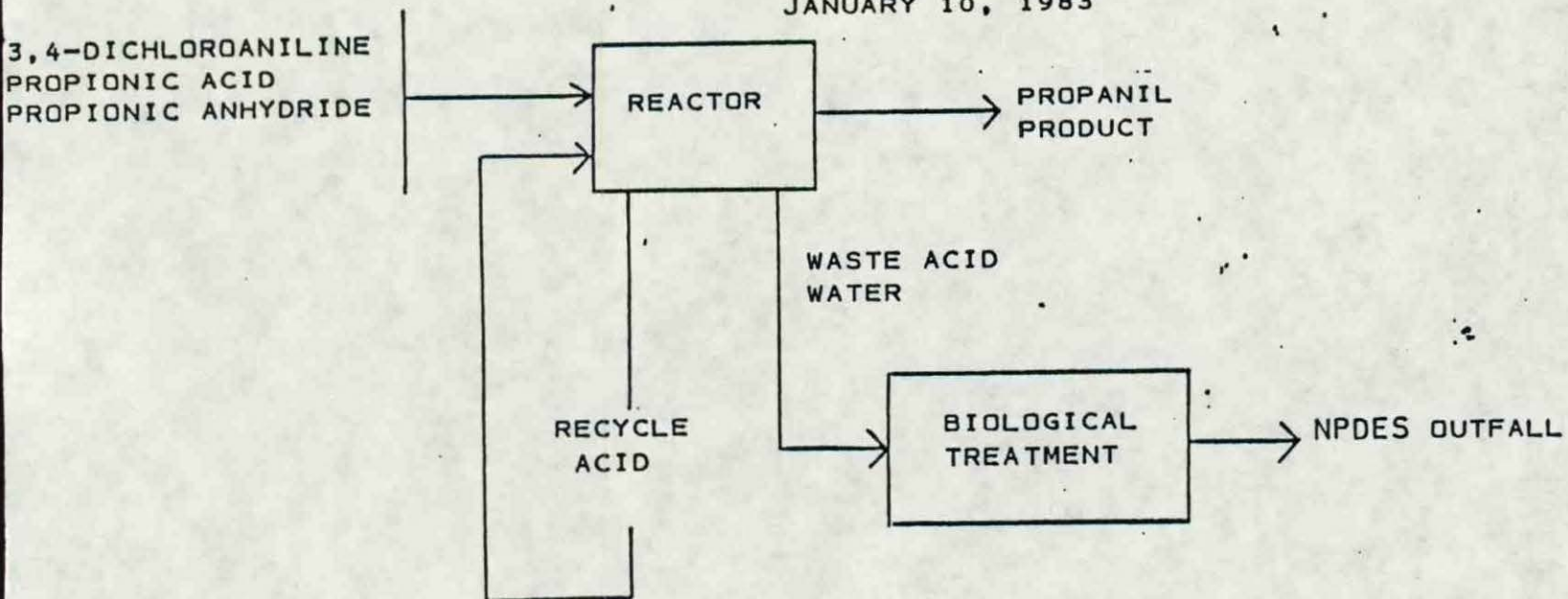


Compound	Formula Weight	Boiling Point	Freeze Point	Solubility in Water	Flash Point	Vapor Pressure
<b>AMP Process</b>						
Formaldehyde, 44%	30	210 F	NA	Infinite	176 F TCC	3.4 @ 95 F
Methyl Alcohol	32	148 F/65 C	-144 F	Completely Miscible	54 F TCC	138 @ 25 C
2-Niropropane	89.1	248 F/120 C	-132 F/-91 C	1.7 % @ 20 C	82 F/28 C	12.9 @ 20 C
NMPD	135.1	149 F/65 C		Completely Miscible	56 F/13 C	MeOH
NEPD	149.1	Water		Completely Miscible	NA	Water
NMP	119.1	212 F/100 C		Miscible	NA	Water
AMPD	105.1	NA	228 F/109 C	250 gm/100 gm @ 20 C	NA	NA (solid)
AEP	119.1	NA	99 F/37 C	Completely Miscible	>200 F	NA
AMP	89.1	212 F/100 C	NA	Completely Miscible	> 200 F	Water
Triethylamine	101.2	194 F/90 C	-175 F/-115 C	10 % @ 20 C 2 % @ 60 C	20 F TCC	52 @ 20 C

VERTAC CHEMICAL CORPORATION

WEST HELENA, ARKANSAS

JANUARY 10, 1983



PROCESS: PROPANIL  
MANUFACTURED FOR: VERTAC CHEMICAL CORPORATION



REF  
#14 NF  
DEC 11 1989  
REGULATORY

CN: 34-0068 PERMIT NO. N/A  
MEDIA: AIR, WATER, SOLID, HAZARDOUS  
SORT: PERMIT, COMPLIANCE  
FEES:

ARKANSAS DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY

MEMORANDUM

TO : Mark Simpson, Geologist, R.S.T. Div. JJ  
FROM : Jay Justice, Hazardous Waste Chemist, T.S. Div.  
DATE : 7-DEC-1989  
SUBJECT : Results from analysis on groundwater samples taken  
at Cedar Chemical Company on October, 17, 1989.

The groundwater samples taken October 17, 1989, at Cedar Chemical Company located at West Helena have been analyzed for Semivolatile Organics and Total Organic Carbon. The results from these analyses are listed below and are expressed in mg/l.

Well #3

TOC	41
Methoxybenzene (1)	0.02
Dichlorobenzene (1)	0.15
Propanil (1)	0.17

Well #6C

TOC	67
Dichloroanilines (1)	25
Chloroaniline (1)	0.1

Well #6A

TOC	1.5
Phenylaniline (1)	0.025

Field Duplicate  
(Well #6C)

TOC	71
Dichloroanilines (1)	25

(1) Denotes a concentration that has been estimated.

cc: Jim Rigg, Geologist II, Groundwater Section  
Hazardous Waste Division

Vertac Chemical Corp.  
West Helena Plant

ARD990660649

6/4/81

Generator's  
checklist

Section B 1.42.

- 7002 110,000 lbs/yr. stored in containers and tanks and treated in surface impoundments
- 7005 1,200,000 lbs/yr. stored in containers and tanks and treated in surface impoundments
- P066 2,200,000 lbs/yr. treated in surface impoundments
- \* P106 120,000 lbs/yr. stored in containers & tanks; treated in tanks and surface impoundments
- 7002 (included with above)
- D000 (included with above)
- U020 80,000,000 lbs/yr. stored in containers & tanks; treated in tanks & surface impoundments
- 7005 (included with above)
- # U220 1,200,00 lbs/yr. stored in containers and tanks
- 7005 (included with above)
- \* D000 31,000,000 lbs/yr. stored in containers & tanks; treated in tanks & surface impoundments
- D001 300,000 lbs/yr. stored in containers and tanks.

\* this waste is empty containers and the rinsate from cleaning the of the containers

# this waste goes to deep well

\* a portion of this waste goes to on-site treatment, some to deep well

The D001 waste stream (kerosene & other petroleum products) is sent to ARCO (Atlantic Richfield Company) Houston, Tx., by rail, to be burnt as a fuel - the waste ~~is~~ is off-spec material manufacturer for ARCO.

Vertac does not handle the following wastes at this time:  
7002, P066, & U020



The P106 (Sodium cyanide) is part of a process waste stream but is currently being transported off-site for deep well injection. Vertac is attempting to include it in their present Biological Treatment which is the reason for the T01 (treatment in tank) designation (experimental treatment) & the T02 (treatment in surface impoundments) to be included if successful.

Waste names: See also Attachment 1

7002 - spent halogenated solvents, 7005 - spent non-halogenated solvents,  
 P066 - methomyl, P106 - sodium cyanide, U020 - benzenesulfonyl chloride  
 D001 - ignitable waste, D000 - toxic waste not specified.

### Section C 1.

Transporter and TSD7 - Chemical Resources, Inc., 2904 4th National  
 Bank Bldg., Tulsa, OK 74119 OKD000402396 H-1 (PC-705)  
 Deep Well Injection

Note: Vertac is not presently storing Hazardous Waste in containers for shipment. It is Vertac's intentions to only use containers as a means of temporary storage - the waste to be pumped out to tank trucks for transportation. There was only one container ~~for~~ of hazardous waste on-site (D001) to be transferred to storage tank.

# MATERIAL SAFETY DATA SHEET

CONFIDENTIAL

FOR HAZARDOUS PRODUCTS USED IN PLACES OF EMPLOYMENT

M3137

## section 1 name & product

manufacturer's name

(a) Hardwicke Chemical Co., for ICI Americas Inc.

emergency phone no (24 hours)

(b) 302-575-3000

street address

(c) Concord Pike & Murphy Road

for latest data, con-  
sult manufacturer.

date this form written

(d) 2/1/79

city, state, zip code

(e) Wilmington, DE 19897

signature of certifying company official  
(f)

chemical name, trade name, and synonyms

(g) 3-Phenoxybenzaldehyde, 3-PBAL, PBAL

formula of primary component(s)

(b) (4)



## Section 6 health hazard data

(b) (4)

# MATERIAL SAFETY DATA SHEET

CONFIDENTIAL

FOR HAZARDOUS PRODUCTS USED IN PLACES OF EMPLOYMENT

M3135

## section 1 name & product

manufacturer's name

(a) ICI Americas Inc.

emergency phone no. (24 hours)

(b) 302-575-3000

street address

(c) Concord Pike & Murphy Road

for latest data, con-  
sult manufacturer.

date this form written

(d) 2/6/79

city, state, zip code

(e) Wilmington, DE 19897

signature of certifying company official

(f)

chemical name, trade name, and synonyms

(g) Cypermethrin (Tenneco 500/100)

formula of primary component(s)

(b) (4)





Section 6. health hazard data Based on testing of the solvent system.

(b) (4)



Ref: Internal

the information herein is given in good faith  
but no warranty, express or implied, is made.

# MATERIAL SAFETY DATA SHEET

FOR HAZARDOUS PRODUCTS USED IN PLACES OF EMPLOYMENT

CONFIDENTIAL

M3134

## section 1 name & product

manufacturer's name

(a) IC! Americas Inc.

emergency phone no. (24 hours)

(b) 302-575-3000

street address

(c) Concord Pike & Murphy Road

for latest data, con-  
sult manufacturer.

date this form written

(d) 1/31/79

city, state, zip code

(e) Wilmington, DE 19897

signature of certifying company official  
(f)

chemical name, trade name, and synonyms

(g) AROMASOL H

formula of primary component(s)

(b) (4)

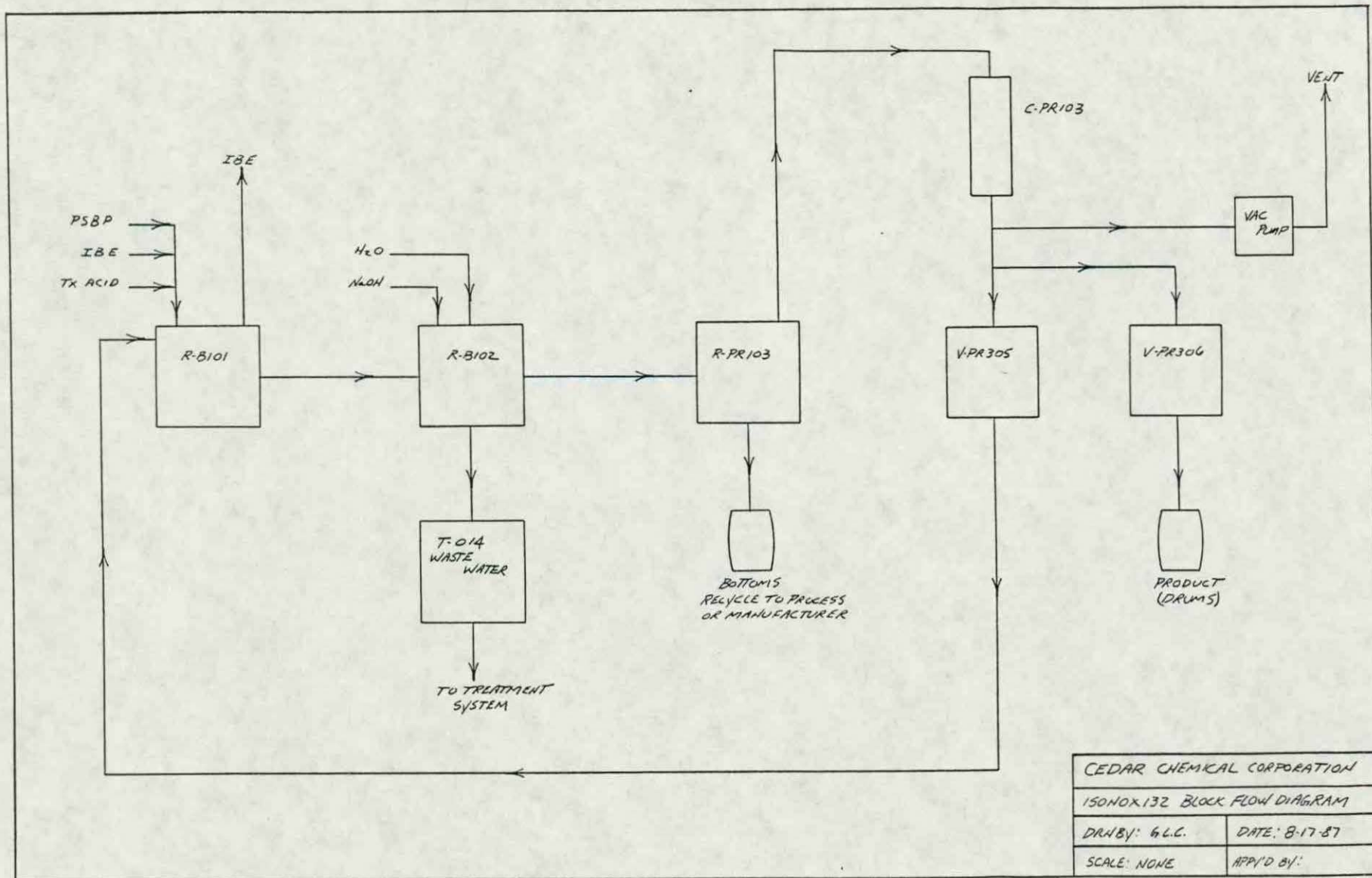


## section 5 health hazard data

(b) (4)

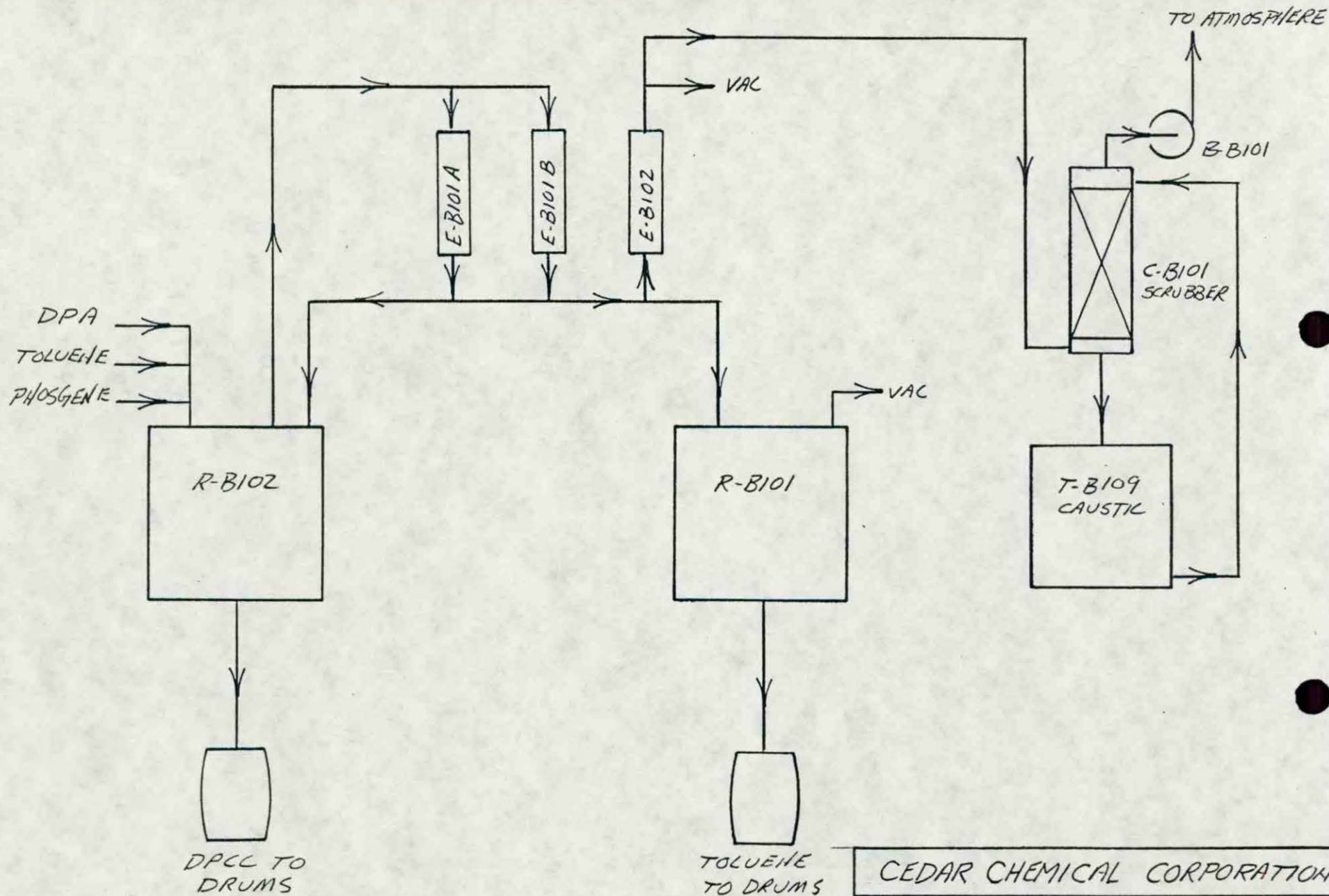
the information herein is given in good faith  
but no warranty, express or implied, is made.

Ref. Internal, ACGIH Tables



SCI 3 months 1986  
2 months 1987





DPA- DIPHENYLAMINE

DPCC- DIPHENYL CARBAMYL CHLORIDE

DPCC 1 Batch 1986

CEDAR CHEMICAL CORPORATION

DPCC BLOCK FLOW DIAGRAM

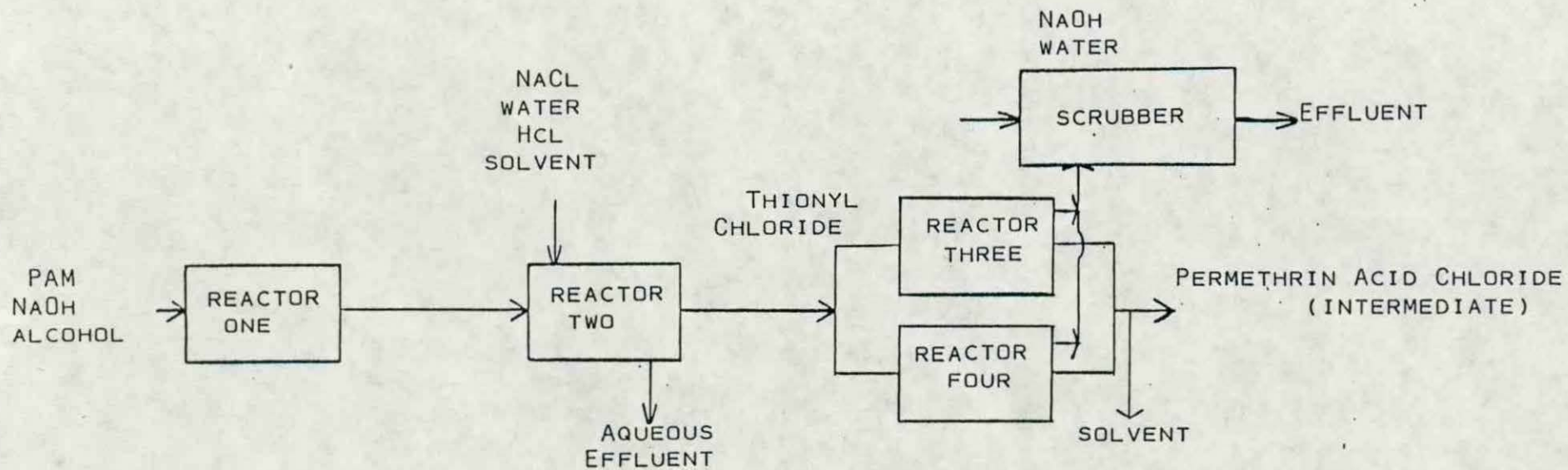
DRN BY: G.L.C.

DATE: 8-26-87

SCALE: NONE

APP'D BY:

VERTAC CHEMICAL CORPORATION  
WEST HELENA, ARKANSAS  
JANUARY 10, 1983

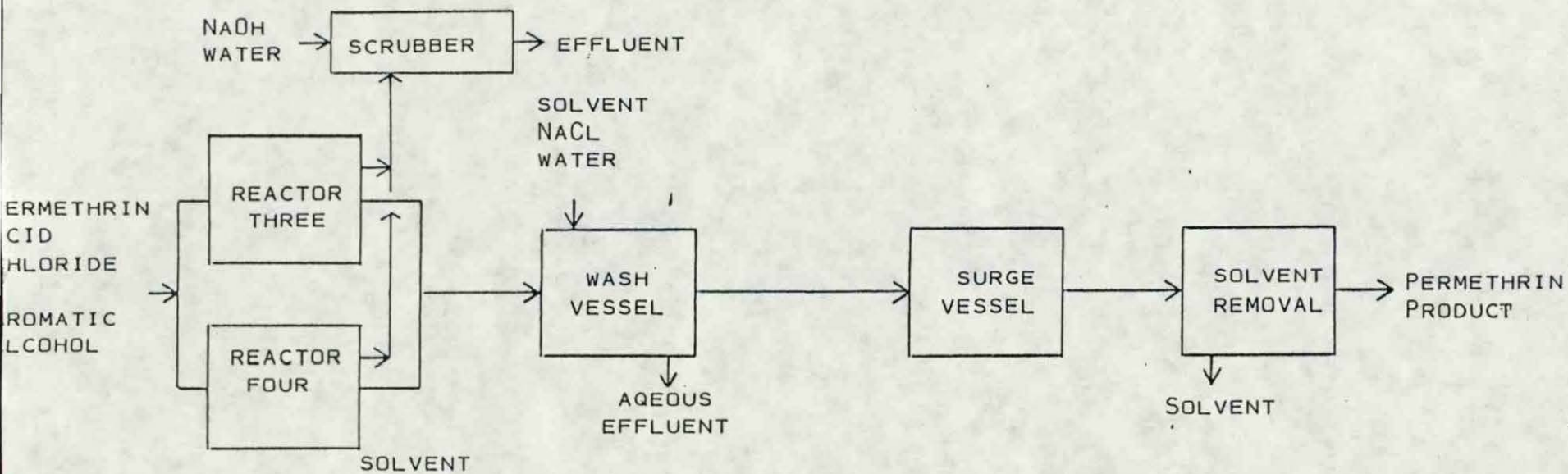


PROCESS: PERMETHRIN ACID CHLORIDE (INTERMEDIATE)

MANUFACTURED FOR: ICI AMERICAS, INC.



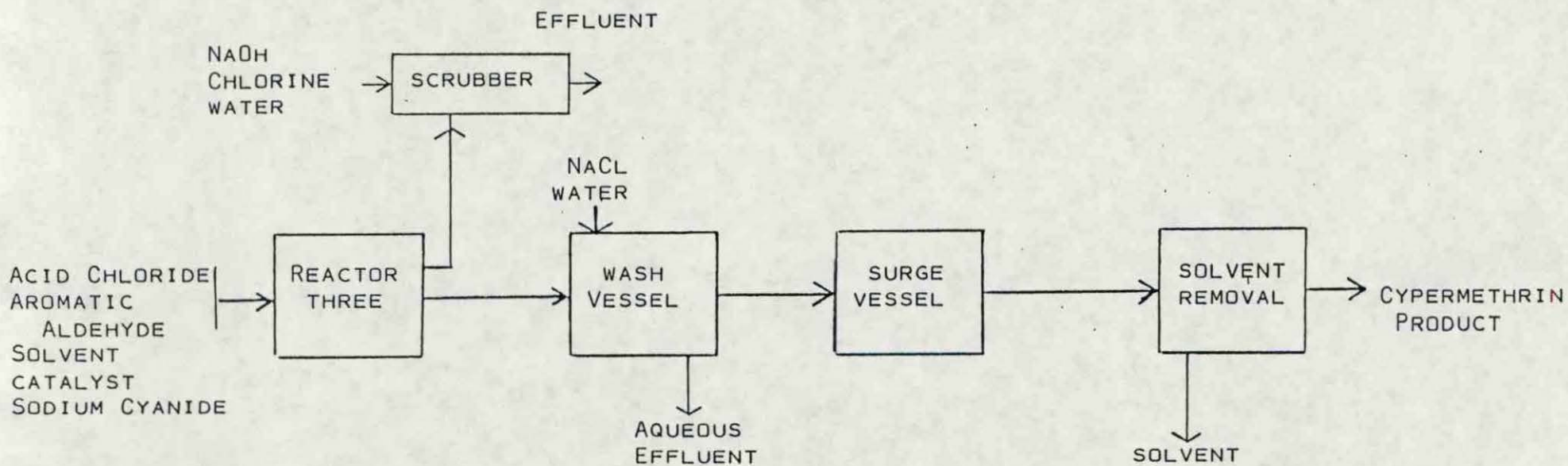
VERTAC CHEMICAL CORPORATION  
WEST HELENA, ARKANSAS  
JANUARY 10, 1983



PROCESS: PERMETHRIN, TECHNICAL

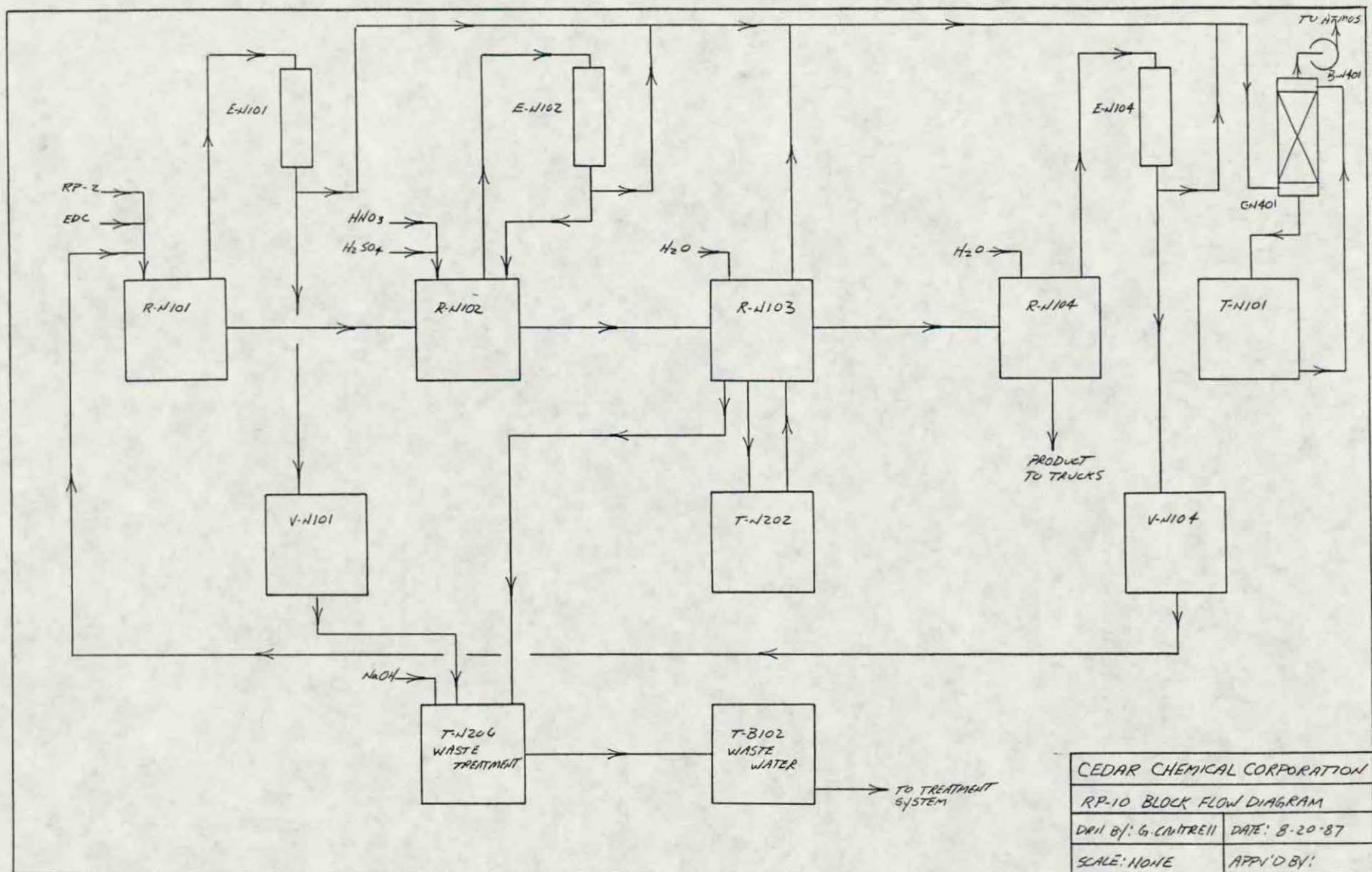
MANUFACTURED FOR: ICI AMERICAS, INC.

VERTAC CHEMICAL CORPORATION  
WEST HELENA, ARKANSAS  
JANUARY 11, 1983

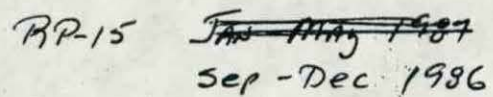


PROCESS: CYPERMETHRIN, TECHNICAL  
MANUFACTURED FOR: ICI AMERICAS





RP-10 JAN-May 1987



BP-15

~~Jan May 1907~~

Sep - Dec 1986

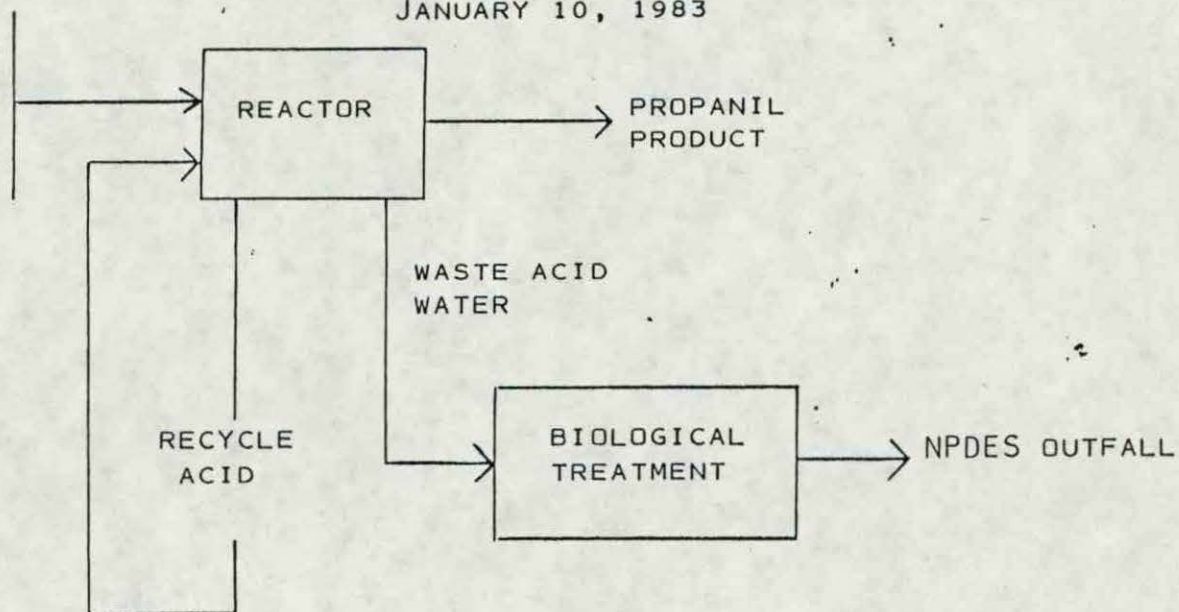


VERTAC CHEMICAL CORPORATION

WEST HELENA, ARKANSAS

JANUARY 10, 1983

3,4-DICHLOROANILINE  
PROPIONIC ACID  
PROPIONIC ANHYDRIDE



PROCESS: PROPANIL  
MANUFACTURED FOR: VERTAC CHEMICAL CORPORATION

## PERMETHRIN PROCESS DESCRIPTION (REVISED 10/79 JEP)

-REFERENCE FIGURE 2

### PAM HYDROLYSIS

THE METHYL ESTER OF PERMETHRIN ACID IS HYDROLYZED TO THE SODIUM SALT IN R-PE101 WITH 17% SODIUM HYDROXIDE AND METHYL ALCOHOL.

### ACIDIFICATION AND EXTRACTION

THE SODIUM SALT OF PERMETHRIN ACID IS THEN TAKEN TO THE FREE ACID WITH HYDROCHLORIC ACID IN R-PE102. THE FREE ACID IS THEN EXTRACTED FROM THE AQUEOUS PHASE WITH TOLUENE. ADDITION OF 9% SODIUM CHLORIDE FACILITATES THIS EXTRACTION BY INCREASING THE SPECIFIC GRAVITY OF THE AQUEOUS PHASE. THE AQUEOUS LAYER IS THEN REMOVED TO THE WASTEWATER TANK. ORGANICS ARE THEN HELD IN R-PE106. THREE CYCLES THROUGH R-1 AND R-2 CONSTITUTE ONE BATCH FOR R-PE106. BATCH CYCLE TIMES THROUGH THESE STEPS ARE APPROXIMATELY 5 1/2 HOURS IN R-1 AND 6 HOURS IN R-2 WITH R-6 BEING HELD AS NECESSARY.

### ACID CHLORIDE FORMATION

R-PE103 AND R-PE104, IN THIS PROCESS, PERFORM THE SAME FUNCTIONS DUE TO BATCH CYCLE TIMES. THEY ARE EQUIPPED WITH IDENTICAL CONDENSING SYSTEMS, RECEIVERS AND UTILIZE THE SAME VACUUM AND SCRUBBER SYSTEMS.

THE ORGANICS ARE FIRST TAKEN TO TEMPERATURE AND PRESSURE TO EFFECT AN AZEOTROPIC STRIP OF WATER AND TOLUENE. WATER REMOVAL IS NECESSARY DUE TO THE SUBSEQUENT ADDITION OF THIONYL CHLORIDE. THIONYL CHLORIDE IS THEN ADDED TO LABORATORY COMPLETION AND REMAINING TOLUENE IS DISTILLED FOR RECYCLE.

### REESTERIFICATION

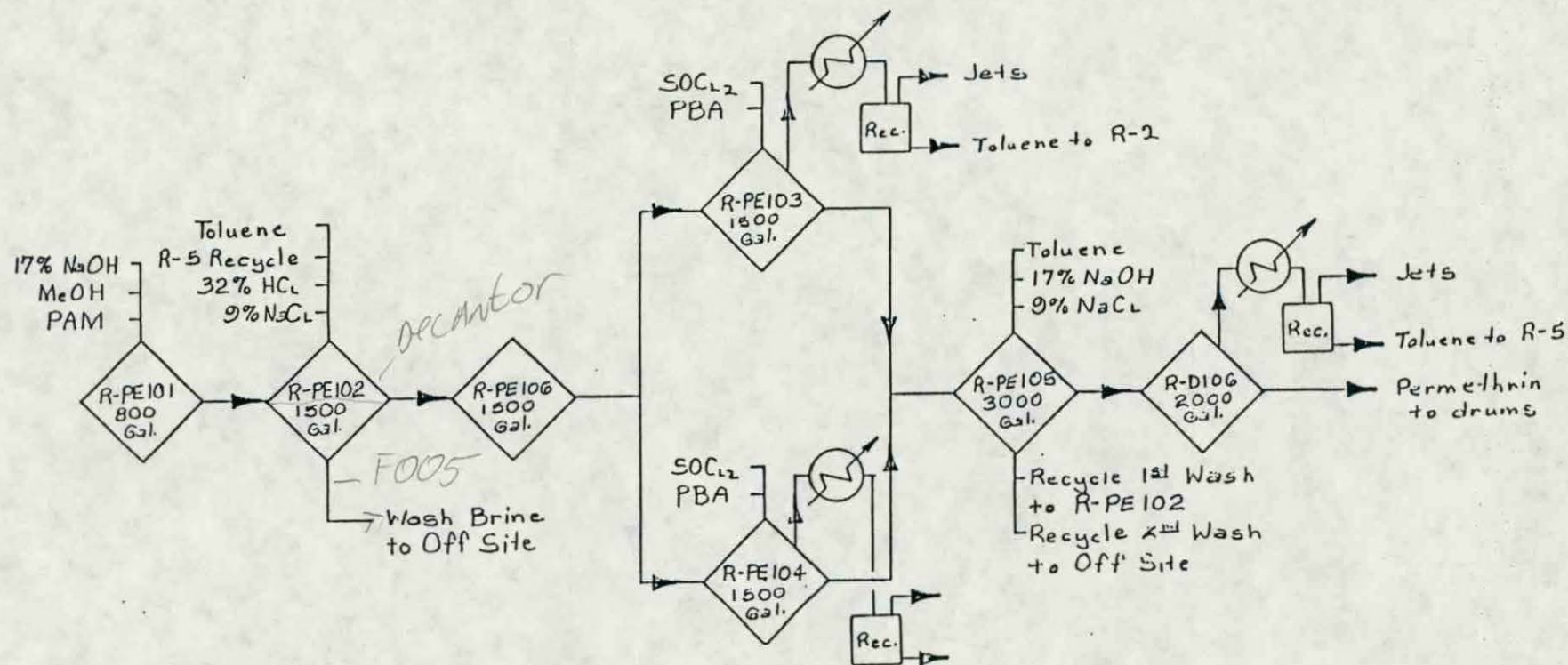
PHENOXYBENZYL ALCOHOL IS ADDED TO FORM THE REESTERIFIED PERMETHRIN ACID. MATERIAL IS THEN TAKEN TO R-PE105 FOR WASHING TO REMOVE EXCESS ACIDS. BATCH CYCLE TIME THROUGH THE R-3/R-4 SYSTEM APPROXIMATELY 23 HOURS. WASHES REQUIRE APPROXIMATELY SIX HOURS.

THE FINAL PRODUCT IS THEN TAKEN TO R-PE107 FOR REMOVAL OF TOLUENE AND LABORATORY ANALYSIS FOR FINAL PRODUCT SPECIFICATIONS. THE FINAL PRODUCT IS THEN DRUMMED AS A TECHNICAL PRODUCT FOR FORMULATION BY OTHERS. R-PE107 IS (11/79) EQUIPPED WITH A BUSCH VACUUM PUMP WITH EMISSIONS TO THE SCRUBBER SYSTEM. FINAL SOLVENT REMOVAL REQUIRES AN ESTIMATED SIX HOURS CYCLE TIME.



# PERMETHRIN PROCESS

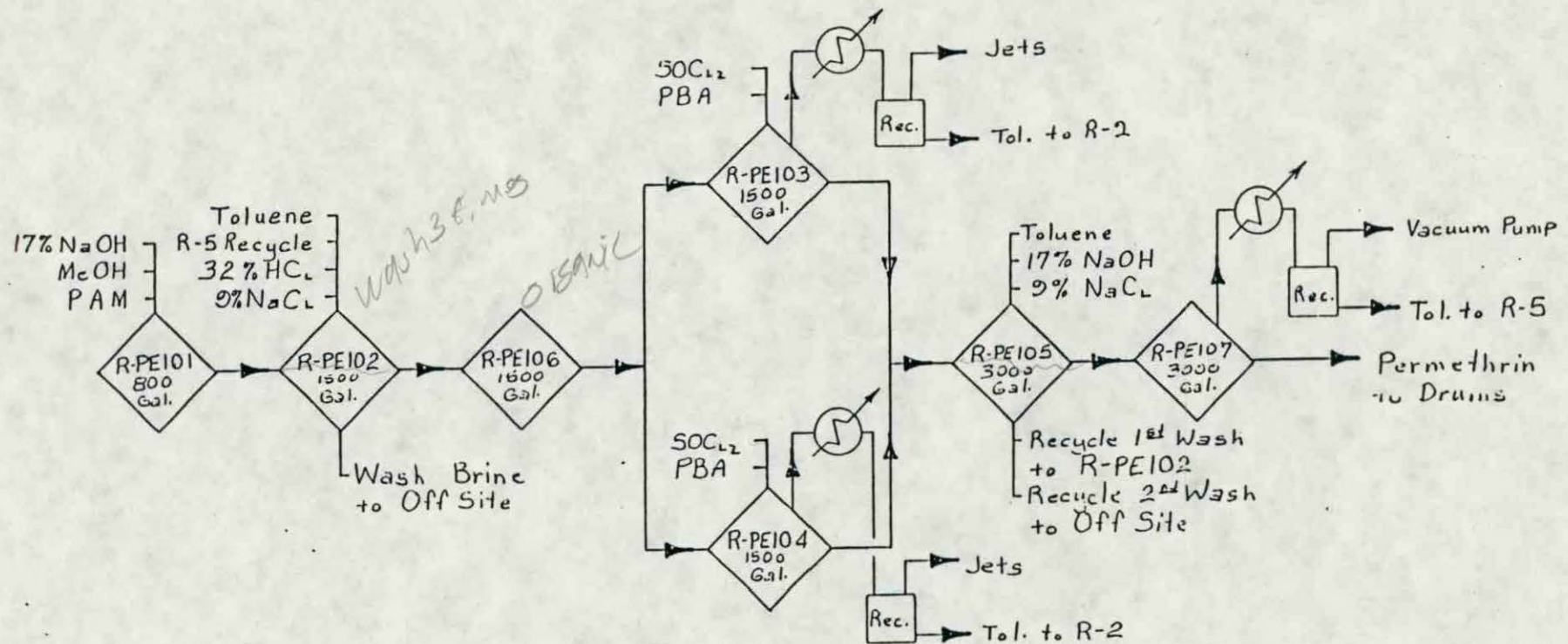
Fig. 1



PRESENT SYSTEM

# PERMETHRIN PROCESS

Fig. 2

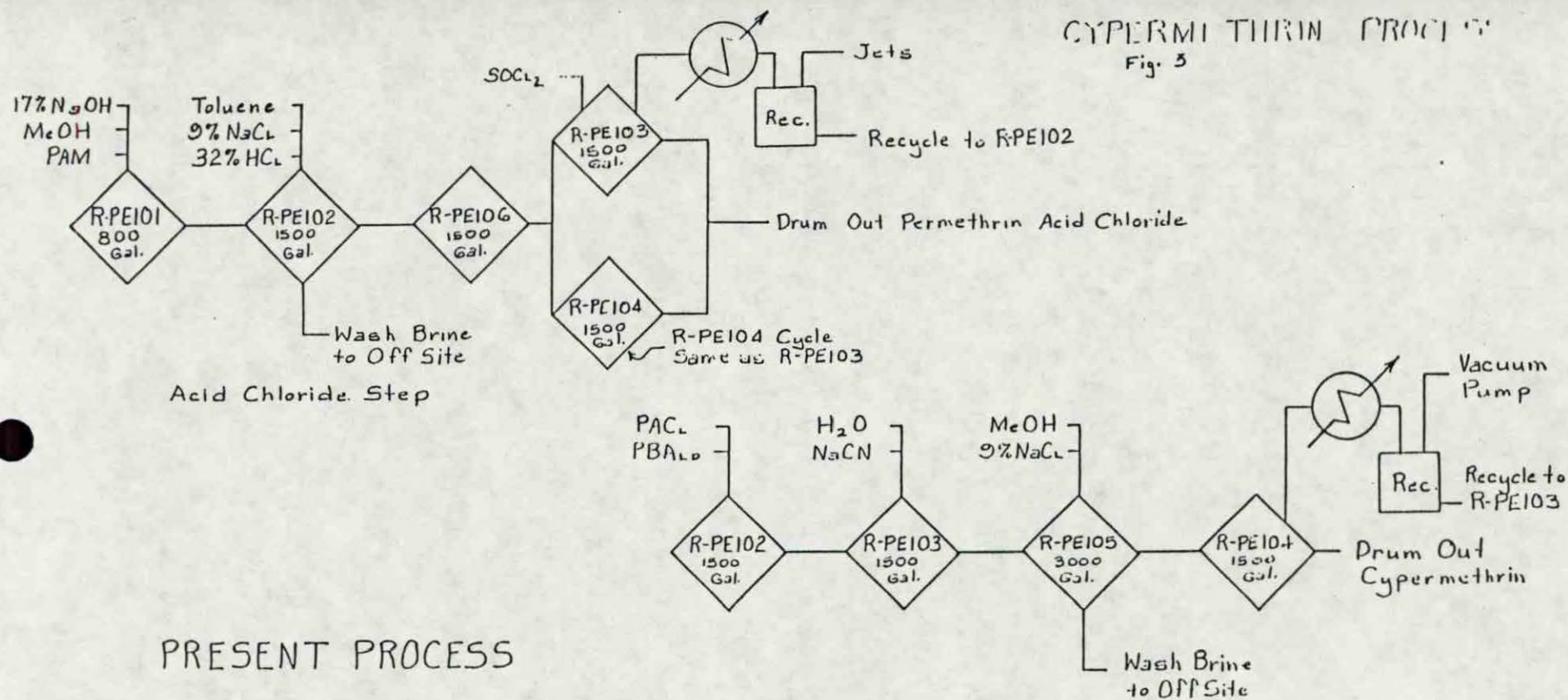


NEW R-7 SYSTEM



# CYPERMETHRIN PROCESS

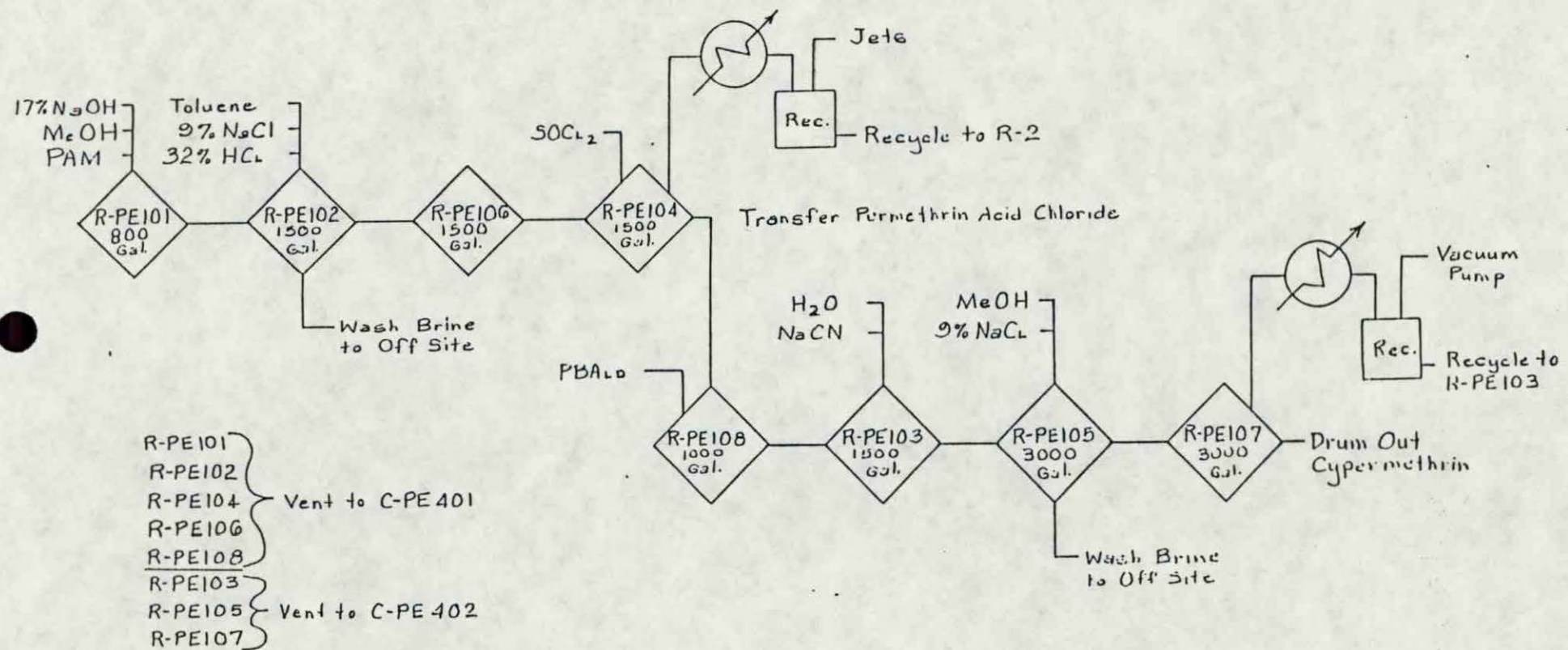
Fig. 5



PRESENT PROCESS

# CYPERMETHRIN PP PROCESS

Fig. 4



NEW R-7, R-8 SYSTEM



1.	a.	(1)	Permethrin Wastewater	
			Sodium Chloride	6.7%
			Sodium Sulfate	1.8
			Methanol	2.1
			Toluene	7.7
			Miscellaneous Organics	1.6
			Water	80.1
			pH	10
			Specific Gravity	1.07
			Flash Point	45°F
		(2)	Cypermethrin Wastewater	
			Sodium Chloride	9.3%
			Sodium Sulfate	1.9
			Sodium Cyanate	1.8
			Sodium Hypochlorite Less Than	0.1
			Tenneco 500 (Solvent)	6.9
			Water	80.1
			pH	9.5
			Specific Gravity	1.083
			Flash Point	80°F
			Cyanide Less Than	0.1 ppm
			Miscellaneous Organics	1.2

Process: 3,4-Dichloropropionanilide (Unit 2)

Basis: Manufactured for Cedar Chemical Corporation and under contract for Rhom & Haas. The formulated products are used solely as herbicides on rice crops.

Raw Materials

3,4-Dichloroaniline (DCA)  
Propionic Acid  
Propionic Anhydride  
Emulsifier  
Isophorone

Products

Propanil, Technical (3,4-Dichloropropionanilide)  
Propanil-3 (3 pound per gallon formulation)  
Propanil-4 (4 pound per gallon formulation)  
Propanil 55% Blend  
Stam M-4 (Rohm & Haas)

Process Description

DCA (3,4-Dichloroaniline) and Propionic Acid are heated. Water formed by the reaction is removed under reflux conditions. the reaction is driven to completion by addition of Propionic Anhydride. The resulting technical grade product may be packaged or formulated with an emulsifier and solvent.

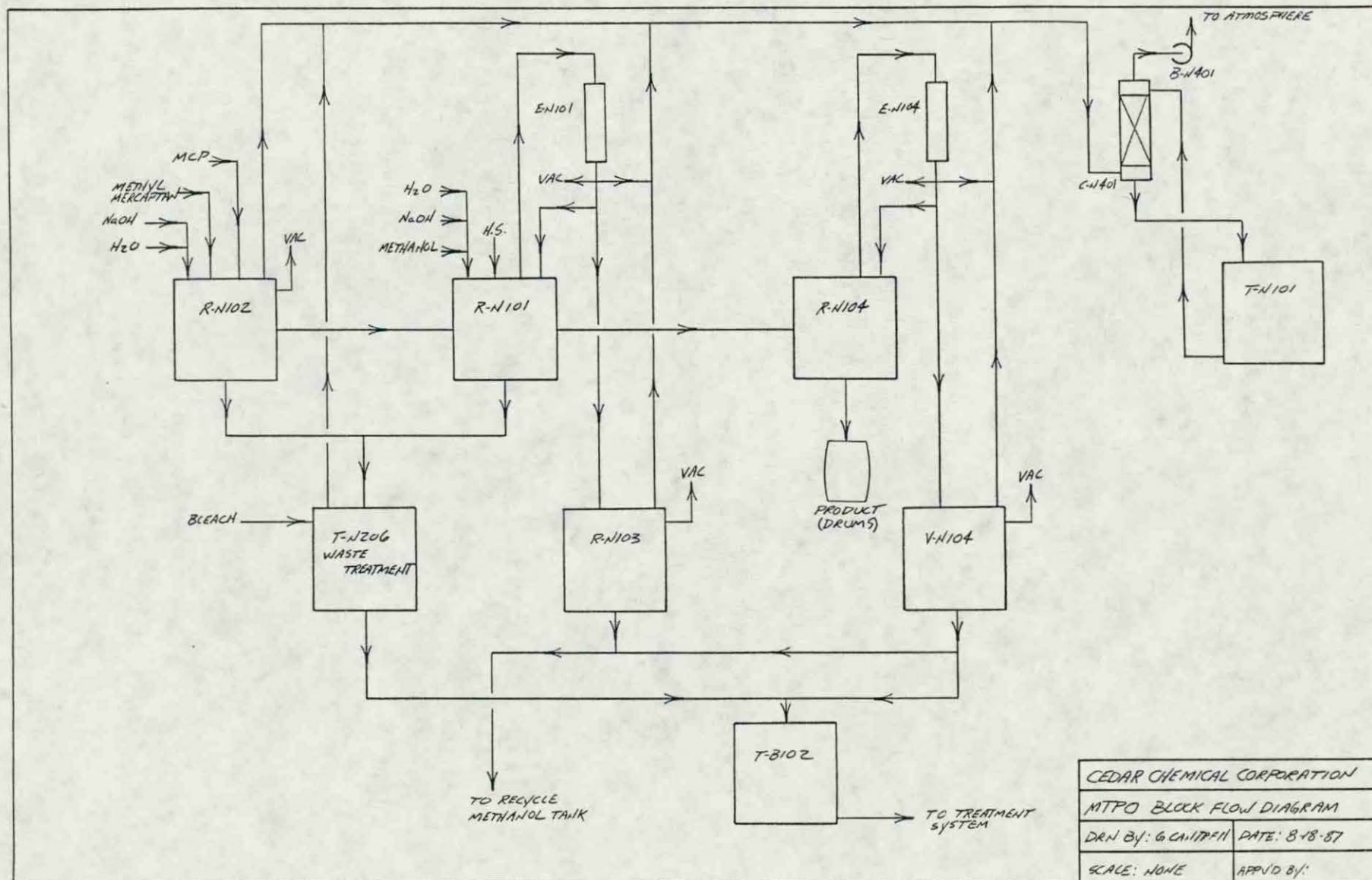
Manufacturing Schedule

Approximately eight months per year. Majority of production is seasonal: December through June. Production for calendar year 1986 of technical grade product: 3.3 million pounds. Estimated 1987 production: 3.5 million pounds. Estimated 1988 production: 4.5 million pounds.

Process Considerations

Propionic acid is recovered and recycled. Aqueous waste containing less than three per cent propionic acid is neutralized if necessary and treated in a biological treatment system. The process is totally enclosed with no point source air emission. Fugitive emissions consist of tank volume changes and pump/valve leakage. VOC loss is calculated on the basis of 1987 production. Total Annual Loss: 23.32 lbs; total daily loss: 0.064 lbs.





MTPO 3 months 1986  
3 months 1987





## FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)
23	24

COMMENTS

## II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

## A. FIRST APPLICATION (place an "X" below and provide the appropriate date)

☒ 1. EXISTING FACILITY (See instructions for definition of "existing" facility. Complete item below.)☐ 2. NEW FACILITY (Complete item below.)

FOR EXISTING FACILITIES, PROVIDE THE DATE (yr., mo., & day) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED (use the boxes to the left)

FOR NEW FACILITIES, PROVIDE THE DATE (yr., mo., & day) OPERATION BEGAN OR IS EXPECTED TO BEGIN

## B. REVISED APPLICATION (place an "X" below and complete Item I above)

☐ 1. FACILITY HAS INTERIM STATUS☐ 2. FACILITY HAS A RCRA PERMIT

## III. PROCESSES - CODES AND DESIGN CAPACITIES

A. PROCESS CODE - Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process (including its design capacity) in the space provided on the form (Item III-C).

B. PROCESS DESIGN CAPACITY - For each code entered in column A enter the capacity of the process.

1. AMOUNT - Enter the amount.

2. UNIT OF MEASURE - For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PRO-CESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER (barrel, drum, etc.)	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS

PROCESS	PRO-CESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET (the volume that would cover one acre to a depth of one foot) OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS

## Treatment:

PROCESS	PRO-CESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING ITEM III (shown in line numbers X-1 and X-2 below): A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

LINE NUMBER	A. PRO-CESS CODE (from list above)	B. PROCESS DESIGN CAPACITY	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PRO-CESS CODE (from list above)	B. PROCESS DESIGN CAPACITY	FOR OFFICIAL USE ONLY
		1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)			1. AMOUNT	2. UNIT OF MEASURE (enter code)
X-1	S 0 2	600	G	5			
X-2	T 0 3	20	E	6			
1	T 0 2	90,000	U	7			
2	S 0 1	20,000	G	8			
3	S 0 2	93,000	G	9			
4	T 0 1	90,000	U	10			



EPA I.D. NUMBER (enter from page 1)															FOR OFFICIAL USE ONLY																			
W A R D 9 9 0 6 6 0 6 4 9															W DUP																			
T/A C 1															T/A C 2 DUP																			
IV. DESCRIPTION OF HAZARDOUS WASTES (continued)																																		
W N O T E	A. EPA HAZARD. WASTE NO. (enter code)				B. ESTIMATED ANNUAL QUANTITY OF WASTE				C. UNIT OF MEASURE (enter code)		D. PROCESSES																							
											1. PROCESS CODES (enter)								2. PROCESS DESCRIPTION (if a code is not entered in D(1))															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	F	0	0	2								P				S	0	1	S	0	2	T	0	2										
2	F	0	0	5								P				S	0	1	S	0	2	T	0	2										
3	P	0	6	6								P				T	0	2																
4	P	1	0	6								P				S	0	1	S	0	2	T	0	1	T	0	2							
5	F	0	0	2																														
6	D	0	0	0																														
7	U	0	2	0								P				S	0	1	S	0	2	T	0	1	T	0	2							
8	F	0	0	5																														
9	U	2	2	0								P				S	0	1	S	0	2													
10	F	0	0	5																														
11	D	0	0	0								P				S	0	1	S	0	2	T	0	1	T	0	2							
12	D	0	0	1								P				S	0	1	S	0	2													
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**III. PROCESSES (continued)**C. SPACE FOR ADDITIONAL PROCESS CODES OR DESCRIBING OTHER PROCESSES (code "T04") FOR EACH PROCESS ENTERED HERE  
INCLUDE DESIGN CAPACITY.

Further explanation of line No. 1 of Part III:

Biological treatment system. Total volume capacity is 12.6MM gallons.  
Working volume is 6.6MM gallons. Design throughput is 90M gallons  
per day. NPDES Permit No. AR-003-6412.

**IV. DESCRIPTION OF HAZARDOUS WASTES**

**A. EPA HAZARDOUS WASTE NUMBER** — Enter the four-digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four-digit number(s) from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

**B. ESTIMATED ANNUAL QUANTITY** — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.

**C. UNIT OF MEASURE** — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE      CODE  
POUNDS ..... P  
TONS ..... T

METRIC UNIT OF MEASURE      CODE  
KILOGRAMS ..... K  
METRIC TONS ..... M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

**D. PROCESSES****1. PROCESS CODES:**

**For listed hazardous waste:** For each listed hazardous waste entered in column A select the code(s) from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.

**For non-listed hazardous wastes:** For each characteristic or toxic contaminant entered in column A, select the code(s) from the list of process codes contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed hazardous wastes that possess that characteristic or toxic contaminant.

**Note:** Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code(s).

**2. PROCESS DESCRIPTION:** If a code is not listed for a process that will be used, describe the process in the space provided on the form.

**NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER** — Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

- Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
- In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
- Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

**EXAMPLE FOR COMPLETING ITEM IV (shown in line numbers X-1, X-2, X-3, and X-4 below)** — A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

W O L Z	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEAS- URE (enter code)	D. PROCESSES							
				1. PROCESS CODES (enter)				2. PROCESS DESCRIPTION (if a code is not entered in D(1))			
X-1	K 0 5 4	900	P	T	0	3	D	8	0		
X-2	D 0 0 2	400	P	T	0	3	D	8	0		
X-3	D 0 0 1	100	P	T	0	3	D	8	0		
X-4	D 0 0 2										included with above



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Lexington, Mass. 02173

# MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 603 - 888 - 2320

Page: 1 of 3

**SECTION ONE - PRODUCT DESCRIPTION**

IDENTITY: **2-AB 1**  
EXPERIMENTAL PRODUCT

MSDS DATE: 09-01-87

CHEMICAL DESCRIPTION: **2-Amino-1-butanol 2**SYNONYMS: 2-Aminobutan-1-ol; butanol-2-amine; D,L-2-amino-1-butanol; ( $\pm$ )2-amino-1-butanolCAS Number: **96-20-8 1**

TSCA LISTING: This product is listed in the TSCA inventory.

**SECTION TWO - HAZARDOUS INGREDIENTS**

CHEMICAL NAME [CAS NUMBER]	PERCENT PRESENT	TLV*	PEL
2-Amino-1-butanol [96-20-8]	~100	N.E.	N.E.

\*Also Grace Internal Limit unless otherwise specified

N.A. = Not applicable

NAIF = No applicable information found

TLV = Threshold Limit Value  
(ACGIH guideline)TWA = Time Weighted Average  
for 8 hrs unless otherwise specified

LEL = Lower Explosive Limit

N.E. = None established

N.D. = Not determined

PEL = Permissible Exposure Limit  
(OSHA legal limit)

C = Ceiling value

UEL = Upper Explosive Limit

**SECTION THREE - PHYSICAL DATA**

APPEARANCE AND ODOR: Pale yellow liquid with a faint, fishy odor.

BOILING POINT: 352°F/178 C<sup>1</sup>

MELTING POINT: N.A.

VAPOR PRESSURE: 7.5 mm Hg @ 25 C<sup>1</sup>

VAPOR DENSITY: ~3.06

WATER SOLUBILITY: Completely miscible.

SPECIFIC GRAVITY: 0.94

% VOLATILE BY WT.: N.A.

EVAPORATION RATE: N.D.

pH of 1% Solution: 11.1 2

**SECTION FOUR - FIRE FIGHTING DATA**

FLASH POINT: 193°F (89 C) 1

FLAMMABLE LIMIT - LEL: N.D.

METHOD: Closed Cup

UEL: N.D.

The information contained herein is based upon data considered true and accurate. However, Grace makes no warranties, express or implied, as to the accuracy or adequacy of the information contained herein or the results to be obtained from the use thereof. This information is offered solely for the user's consideration, investigation and verification. Since the use and conditions of use of this information and the material described herein are not within the control of Grace, Grace assumes no responsibility for injury to the user or third persons. The material described herein is sold only pursuant to Grace's terms and Conditions of Sale, including those relating to warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of this data and information is in accordance with applicable federal, state or local laws and regulations.



EXTINGUISHING MEDIA: Water, dry chemical, carbon dioxide, foam.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self contained breathing apparatus with full face-piece. Use water spray to cool fire-exposed containers.

UNUSUAL FIRE & EXPLOSION HAZARDS: Combustible liquid.

---

## SECTION FIVE - HEALTH & FIRST AID DATA

PRIMARY ROUTES OF EXPOSURE: Eye and skin contact. Inhalation exposure is not likely unless material is heated or a mist is generated.

HEALTH HAZARDS (ACUTE AND CHRONIC): Oral LD<sub>50</sub> for mice is 2300 mg/kg - slightly toxic by ingestion. Due to pH may be irritating to eyes and skin. Inhalation of heated vapor or a mist may be irritating to the respiratory tract.

CARCINOGENICITY: This material is not listed by NTP, IARC, or OSHA as a suspect or proven carcinogen. There is no evidence that indicates the material may be carcinogenic to humans or animals.

SIGNS & SYMPTOMS OF OVEREXPOSURE: Redness, burning, tearing of eyes. Red, swollen, or inflamed skin. Coughing, wheezing, chest tightness.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Persons with pre-existing skin or lung disorders may be more susceptible to the irritating properties of the material.

### EMERGENCY AND FIRST AID PROCEDURES:

Eye Contact: Immediately flush with large quantities of water for at least 15 minutes while holding the eyelids open. Do not attempt to neutralize with chemical agents. Contact a physician immediately.

Skin Contact: Immediately remove contaminated clothing and flush area with large quantities of water for at least 15 minutes. Do not attempt to neutralize with chemical agents. Contact a physician immediately.

Ingestion: If conscious, give large quantities of water to drink. Do not induce vomiting. Do not give an unconscious person anything by mouth. Contact a physician immediately.

Inhalation: Remove from contaminated atmosphere. If breathing has stopped, give artificial respiration then oxygen if needed. Contact a physician immediately.

---

## SECTION SIX - REACTIVITY DATA

STABILITY: Stable.

CONDITIONS TO AVOID: N.A.

INCOMPATIBILITY WITH OTHER MATERIALS: Oxidizing materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, carbon dioxide, nitrogen oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID UNCONTROLLED POLYMERIZATION: N.A.



---

**SECTION SEVEN - SPILL & DISPOSAL PROCEDURES**

STEPS TO BE TAKEN TO HANDLE SPILLS OR RELEASES: Evacuate area of nonessential personnel. Ventilate area. Prevent from entering drinking water supplies or streams. Collect with absorbent material and package for disposal according to local, state, and federal regulations.

WASTE DISPOSAL PROCEDURES: Check the as is pH. If above 12.5 classify and label as follows:

EPA Name: Corrosive.....No. = D002

---

**SECTION EIGHT - SPECIAL PROTECTION INFORMATION**

VENTILATION: If necessary, appropriate exhaust ventilation for the handling conditions is recommended. Dilution ventilation is not recommended as the sole control mechanism.

PROTECTIVE EQUIPMENT: Minimum - chemical safety goggles with side shields and impervious gloves. Do not wear contact lenses when handling chemicals. Wear impervious clothing if possibility of body contact exists.

RESPIRATORY PROTECTION: Use an approved organic vapor respirator within use limitations. In all other situations use self-contained breathing apparatus.

---

**SECTION NINE - SPECIAL PRECAUTIONS**

WORK/HYGIENIC PRACTICES: Wash thoroughly after handling. Wash contaminated clothes before re-use. Launder work clothes separately from family clothes. Check protective clothing, especially impervious gloves, for leaks before use.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Do not store near oxidizing materials. Store in cool, dry, and well ventilated area. Keep containers closed. Use only DOT-approved containers. Do not enter storage area unless area is adequately ventilated.



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# MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 603 - 888 - 2320

Page: 1 of 3

## SECTION ONE - PRODUCT DESCRIPTION

IDENTITY: **TA-100**  
EXPERIMENTAL PRODUCT

MSDS DATE: 09-01-87

CHEMICAL DESCRIPTION: **1,3-Propanediol; 2-amino-2-(hydroxymethyl)**  
SYNONYMS: Tris(hydroxymethyl)aminomethane; TRIS buffer; THAM; Tromethane; Talatrol

CAS Number: **77-86-1**  
TSCA LISTING: This product is listed in the TSCA inventory.

## SECTION TWO - HAZARDOUS INGREDIENTS

CHEMICAL NAME [CAS NUMBER]	PERCENT PRESENT	TLV*	PEL
TA-100 [77-86-1]	~100	N.E.	N.E.

\*Also Grace Internal Limit unless otherwise specified

N.A. = Not applicable

NAIF = No applicable information found

TLV = Threshold Limit Value

(ACGIH guideline)

TWA = Time Weighted Average

for 8 hrs unless otherwise specified

LEL = Lower Explosive Limit

N.E. = None established

N.D. = Not determined

PEL = Permissible Exposure Limit

(OSHA legal limit)

C = Ceiling value

UEL = Upper Explosive Limit

## SECTION THREE - PHYSICAL DATA

APPEARANCE AND ODOR: White crystalline solid with a faint, fishy odor.

BOILING POINT: N.A.

MELTING POINT: 340°F (171 C)

VAPOR PRESSURE: N.A.

VAPOR DENSITY: N.A.

WATER SOLUBILITY: 70g/100g at 25 C

BULK DENSITY: 52 lb/ft<sup>3</sup>

% VOLATILE BY WT.: N.A.

EVAPORATION RATE: N.A.

pH of 1% Solution: 10.4

## SECTION FOUR - FIRE FIGHTING DATA

FLASH POINT: N.A.

FLAMMABLE LIMIT - LEL: N.A.

METHOD: N.A.

UEL: N.A.

The information contained herein is based upon data considered true and accurate. However, Grace makes no warranties, express or implied, as to the accuracy or adequacy of the information contained herein or the results to be obtained from the use thereof. This information is offered solely for the user's consideration, investigation and verification. Since the use and conditions of use of this information and the material described herein are not within the control of Grace, Grace assumes no responsibility for injury to the user or third persons. The material described herein is sold only pursuant to Grace's Terms and Conditions of Sale, including those limiting warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of this data and information is in accordance with applicable federal, state or local laws and regulations.



EXTINGUISHING MEDIA: Water, dry chemical, carbon dioxide, foam.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self contained breathing apparatus with full face-piece. Use water spray to cool fire-exposed containers.

UNUSUAL FIRE & EXPLOSION HAZARDS: Severe dusting may generate an explosion hazard.

---

#### SECTION FIVE - HEALTH & FIRST AID DATA

PRIMARY ROUTES OF EXPOSURE: Eye and skin contact. Inhalation exposure is not likely unless handling condition generates a dust.

HEALTH HAZARDS (ACUTE AND CHRONIC): Oral LD<sub>50</sub> for rabbits is 1000 mg/kg expected to be slightly toxic by ingestion. Due to pH may be irritating to eyes and skin. Inhalation of dust may be irritating to the respiratory tract.

CARCINOGENICITY: This material is not listed by NTP, IARC, or OSHA as a suspect or proven carcinogen. There is no evidence that indicates the material may be carcinogenic to humans or animals.

SIGNS & SYMPTOMS OF OVEREXPOSURE: Redness, burning, tearing of eyes, Red, swollen, or inflamed skin. Coughing, wheezing, chest tightness.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Persons with pre-existing skin or lung disorders may be more susceptible to the irritating properties of the material.

#### EMERGENCY AND FIRST AID PROCEDURES:

Eye Contact: Immediately flush with large quantities of water for at least 15 minutes while holding the eyelids open. Do not attempt to neutralize with chemical agents. Contact a physician immediately.

Skin Contact: Immediately remove contaminated clothing and flush area with large quantities of water for at least 15 minutes. Do not attempt to neutralize with chemical agents. Contact a physician immediately.

Ingestion: If conscious, give large quantities of water to drink. Do not induce vomiting. Do not give an unconscious person anything by mouth. Contact a physician immediately.

Inhalation: Remove from contaminated atmosphere. If breathing has stopped, give artificial respiration then oxygen if needed. Contact a physician immediately.

---

#### SECTION SIX - REACTIVITY DATA

STABILITY: Stable.

CONDITIONS TO AVOID: N.A.

INCOMPATIBILITY WITH OTHER MATERIALS: Oxidizing materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, carbon dioxide, nitrogen oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID UNCONTROLLED POLYMERIZATION: N.A.



---

**SECTION SEVEN - SPILL & DISPOSAL PROCEDURES**

STEPS TO BE TAKEN TO HANDLE SPILLS OR RELEASES: Evacuate area of nonessential personnel. Ventilate area. Prevent from entering drinking water supplies or streams. Collect and package for disposal according to local, state, and federal regulations.

WASTE DISPOSAL PROCEDURES: Check the as is pH. If above 12.5 classify and label as follows:

EPA Name: Corrosive.....No. = D002

---

**SECTION EIGHT - SPECIAL PROTECTION INFORMATION**

VENTILATION: If necessary, appropriate exhaust ventilation for the handling conditions is recommended. Dilution ventilation is not recommended as the sole control mechanism.

PROTECTIVE EQUIPMENT: Minimum - chemical safety goggles with side shields and impervious gloves. Do not wear contact lenses when handling chemicals. Wear impervious clothing if possibility of body contact exists.

RESPIRATORY PROTECTION: Use a toxic dust respirator within use limitations. In all other situations use self-contained breathing apparatus.

---

**SECTION NINE - SPECIAL PRECAUTIONS**

WORK/HYGIENIC PRACTICES: Wash thoroughly after handling. Wash contaminated clothes before re-use. Launder work clothes separately from family clothes. Check protective clothing, especially impervious gloves, for leaks before use.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Do not store near oxidizing materials. Store in cool, dry, and well ventilated area. Keep containers closed. Use only DOT-approved containers. Do not enter storage area unless area is adequately ventilated.



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# MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 713 - 479 - 7348

## SECTION ONE - PRODUCT DESCRIPTION

IDENTITY: 2-Nitropropane<sup>†</sup>

MSDS DATE: 05-13-87

SYNONYMS: 2-NP, Nitropropane

CHEMICAL FORMULA:  $\text{CH}_3\text{CH}(\text{NO}_2)\text{CH}_3$

CAS Number: 79-46-9 <sup>†</sup>

TSCA LISTING: This product is listed in the TSCA inventory.

## SECTION TWO - HAZARDOUS INGREDIENTS

CHEMICAL NAME [CAS NUMBER]	PERCENT PRESENT	TLV*	PEL
2-Nitropropane [79-46-9]	>94	10 ppm TWA	25 ppm TWA
Nitromethane [75-52-5]	<1	100 ppm TWA	100 ppm TWA
Nitroethane [79-24-3]	<3	100 ppm TWA	100 ppm TWA
1-Nitropropane [108-03-2]	<3	25 ppm TWA	25 ppm TWA

\*Also Grace Internal Limit unless otherwise specified

N.A. = Not applicable

N.E. = None established

NAIF = No applicable information found

TLV = Threshold Limit Value

PEL = Permissible Exposure Limit  
(OSHA legal limit)

(ACGIH guideline)

TWA = Time Weighted Average

C = Ceiling value

for 8 hrs unless otherwise specified

LEL = Lower Explosive Limit

UEL = Upper Explosive Limit

## SECTION THREE - PHYSICAL DATA

APPEARANCE AND ODOR: Colorless liquid with mild, fruity odor.

BOILING POINT: 248°F/120°C

SPECIFIC GRAVITY: 0.99 (Water = 1)

FREEZING POINT: -132°F/-91°C

% VOLATILE BY WT.: 100

VAPOR PRESSURE: 12.9 mm Hg @ 20°C <sup>†</sup>

EVAPORATION RATE: 1.1 (BuAc = 1)

VAPOR DENSITY: 3.1 (Air = 1)

WATER SOLUBILITY: 1.7% wt @ 20°C - slightly soluble

The information contained herein is based upon data considered true and accurate. However, Grace makes no warranties, express or implied, as to the accuracy or adequacy of the information contained herein or the results to be obtained from the use thereof. This information is offered solely for the user's consideration, investigation and verification. Since the use and conditions of use of this information and the material described herein are not within the control of Grace, Grace assumes no responsibility for injury to the user or third persons. The material described herein is sold only pursuant to Grace's Terms and Conditions of Sale, including those limiting warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of this data and information is in accordance with applicable federal, state or local laws and regulations.



#### SECTION FOUR - FIRE FIGHTING DATA

NFPA Ratings (applicable to fire fighting situations only): ~~Health -2~~ ~~Flammability-3~~ ~~Reactivity-7~~

FLASH POINT: 82°F/28°C

METHOD: Closed Cup

FLAMMABLE LIMIT - LEL: 2.6%

UEL: 11.0%

APPROXIMATE IGNITION TEMPERATURE: 802°F/428°C

EXTINGUISHING MEDIA: Water spray, dry chemical, foam, carbon dioxide, or Halon system.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self contained breathing apparatus. Fight fires from an explosion-resistant location. Cool drums and tanks with water spray and continue to cool after fire has been extinguished. Stay upwind and out of low areas. If tank or truck is involved in a fire, isolate for 1/2 mile in all directions.

UNUSUAL FIRE & EXPLOSION HAZARDS: ~~Flammable liquid~~ Combustion products may contain nitrogen oxides or carbon oxides. Vapor is heavier than air and may travel a considerable distance to ignition source and flashback.

#### SECTION FIVE - HEALTH & FIRST AID DATA

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH: 2300 ppm.

PRIMARY ROUTES OF EXPOSURE: Inhalation of mist or vapor. Eye and skin contact.

WARNING PROPERTIES: One report of odor detectable at 5 ppm and another report of odor detectable at ~160 ppm. Consider to have poor warning properties.

HEALTH HAZARDS (ACUTE AND CHRONIC): Oral LD<sub>50</sub> for rats is 725 mg/kg. Inhalation LC<sub>50</sub> for 6 hr. for rats is 400 ppm. Irritating to eyes. Chronic exposure may cause liver damage. Chronic exposure of animals indicates possible effects to the kidneys and heart. Has caused formation of methemoglobin in animal studies. In one study injection of 170 mg/kg 2-NP into female mice on days 1 through 15 of gestation caused delayed heart formation in the offspring. Weak narcotic and respiratory irritant.

CARCINOGENICITY: Based on animal studies 2-NP has been listed by IARC and NTP as a suspect carcinogen but is not listed by OSHA. Other components are not listed by NTP, IARC, or OSHA as suspect or proven carcinogen.

SIGNS & SYMPTOMS OF OVEREXPOSURE: Headache, nausea, vomiting, diarrhea, dizziness, weakness. Burning, soreness in nose, throat, or lungs.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Persons with pre-existing lung conditions may be more susceptible to irritation effects. Persons with impaired liver function may be more susceptible to effects from liver damage.

#### EMERGENCY AND FIRST AID PROCEDURES:

Eye Contact: Immediately flush with large quantities of water for at least 15 minutes while holding the eyelids open. Contact a physician immediately.

Skin Contact: Immediately remove contaminated clothing and flush area with large quantities of water for at least 15 minutes. Contact a physician if irritation develops.



Ingestion: Induce vomiting if patient is conscious. Do not induce vomiting in an unconscious patient. Contact a physician immediately.

Inhalation: Remove from contaminated atmosphere. If breathing has stopped, give artificial respiration then oxygen if needed. Contact a physician immediately. Effects of inhalation overexposure may not be immediately obvious. If overexposure is severe, patient should be observed for a minimum of 2 days.

---

## SECTION SIX - REACTIVITY DATA

STABILITY: Stable.

CONDITIONS TO AVOID: High temperatures cause decomposition. Unlike nitromethane and nitroethane, no detonations of 2-NP have been reported even under very severe test conditions. However, mixing with amines, alkalies, acids, and other materials will cause 2-NP to become unstable.

INCOMPATIBILITY WITH OTHER MATERIALS: Amines, strong acids, alkalies (lye, caustic), strong oxidizers, metal oxides, hydrocarbons and other combustible materials. Lead, copper, and their alloys.

HAZARDOUS DECOMPOSITION PRODUCTS: Nitrogen oxides, carbon oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID UNCONTROLLED POLYMERIZATION: N.A.

---

## SECTION SEVEN - SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN TO HANDLE SPILLS OR RELEASES: Evacuate area of nonessential personnel. Ventilate area. Eliminate ignition sources. No flames, sparks or flares allowed in spill area. Vapor may collect in low areas or travel a considerable distance to ignition source and flash back. Prevent from entering drinking water supplies or streams. Collect with non-combustible absorbent material and package for disposal according to local, state, and federal regulations.

WASTE DISPOSAL PROCEDURES: When disposing of pure product as a waste according to EPA regulation 40 CFR 261 classify and label as follows:

DOT Name and Number = Waste Nitropropane, UN2608

EPA Name and Number = Ignitable, No. = D001

---

## SECTION EIGHT - SPECIAL PROTECTION INFORMATION

VENTILATION: Appropriate exhaust ventilation for the handling conditions is recommended. Dilution ventilation is not recommended as the sole control mechanism.

PROTECTIVE EQUIPMENT: Minimum - chemical safety goggles with side shields and impervious gloves. Do not wear contact lenses when handling chemicals. Wear impervious clothing if possibility of body contact exists.

RESPIRATORY PROTECTION: Use pressure-type supplied air or self-contained breathing apparatus. Do not use cartridge-type respirators.



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**SECTION NINE - SPECIAL PRECAUTIONS**

**WORK/HYGIENIC PRACTICES:** Before entering a confined space, check for vapor accumulation. Wash thoroughly after handling. Wash contaminated clothes before re-use. Launder work clothes separately from family clothes. Check protective clothing, especially impervious gloves, for leaks before use. Transfer equipment must be grounded. Do not use lye or caustic to clean drums or equipment that has contacted 2-NP. Dry salts of inorganic bases and 2-NP are explosive.

**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:** Store in cool, dry, and well ventilated area. Keep containers closed to maintain nitrogen blanket. Use only DOT-approved containers. Do not enter storage area unless area is adequately ventilated. Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Nitropropane storage areas should be isolated from flammable liquids or gases. Explosives and hazardous processing should not be permitted in the vicinity of this storage area. Separate from oxidizing materials. Dry product may be stored in steel. Wet product (>2% water) must be stored in stainless steel or aluminum.

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**SECTION TEN - REGULATORY COMMENTS**

2-Nitropropane is not a hazardous substance (40 CFR 116), toxic pollutant (40 CFR 129), or "priority pollutant" pursuant to the Federal Water Pollution Control Act, sections 311 (b)(2)(A), 307 (a).

2-Nitropropane is not a hazardous air pollutant (40 CFR 61) pursuant to the Clean Air Act, section 112.

2-Nitropropane is minimally photochemically reactive and, therefore, is classified as a solvent exempt from volume restrictions under Rule 66 of the Air Pollution Control District of Los Angeles County, Regulation 3 of the Bay Area Pollution Control District, or other similar pollution legislation in the United States.



# MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 713 - 479 - 7348

Page: 1 of 4

## SECTION ONE - PRODUCT DESCRIPTION

IDENTITY: 1-Nitropropane

MSDS DATE: 01-20-88

SYNONYMS: 1-NP

CHEMICAL FORMULA:  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NO}_2$ 

CAS Number: 108-03-2

TSCA LISTING: This product is listed in the TSCA inventory.

## SECTION TWO - HAZARDOUS INGREDIENTS

CHEMICAL NAME [CAS NUMBER]	PERCENT PRESENT	TLV*	PEL
1-Nitropropane [108-03-2]	>94	25 ppm TWA	25 ppm TWA
2-Nitropropane [79-46-9]	<3	10 ppm TWA	25 ppm TWA
Nitromethane [75-52-5]	<1	100 ppm TWA	100 ppm TWA
Nitroethane [79-24-3]	<1	100 ppm TWA	100 ppm TWA

\*Also Grace Internal Limit unless otherwise specified

N.A. = Not applicable

N.E. = None established

NAIF = No applicable information found

TLV = Threshold Limit Value  
(ACGIH guideline)PEL = Permissible Exposure Limit  
(OSHA legal limit)TWA = Time Weighted Average  
for 8 hrs unless otherwise specified

C = Ceiling value

LEL = Lower Explosive Limit

UEL = Upper Explosive Limit

## SECTION THREE - PHYSICAL DATA

APPEARANCE AND ODOR: Colorless liquid with mild, fruity odor.

BOILING POINT: 268°F/131°C

SPECIFIC GRAVITY: 1.00 (Water = 1)

FREEZING POINT: -162°F/-108°C

% VOLATILE BY WT.: 100%

VAPOR PRESSURE: 7.5 mm Hg @ 20°C

EVAPORATION RATE: 0.88 (BuAc = 1)

VAPOR DENSITY: 3.1 (Air = 1)

WATER SOLUBILITY: 1.4% wt @ 20°C



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**SECTION FOUR - FIRE FIGHTING DATA**

NFPA Ratings (applicable to fire fighting situations only): Health -2, Flammability-3, Reactivity-1

FLASH POINT: 96°F/36C

METHOD: Closed Cup

FLAMMABLE LIMIT - LEL: 2.2%

UEL: Unknown

APPROXIMATE IGNITION TEMPERATURE: 789°F/421C

EXTINGUISHING MEDIA: Water spray, dry chemical, foam, carbon dioxide, or Halon system.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self contained breathing apparatus. Fight fires from an explosion-resistant location. Cool drums and tanks with water spray and continue to cool after fire has been extinguished. Stay upwind and out of low areas. If tank or truck is involved in a fire, isolate for  $1\frac{1}{2}$  mile in all directions.

UNUSUAL FIRE & EXPLOSION HAZARDS: Flammable liquid. Combustion products may contain nitrogen oxides or carbon oxides. Vapor is heavier than air and may travel a considerable distance to ignition source and flashback.

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**SECTION FIVE - HEALTH & FIRST AID DATA**

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH: 2300 ppm

PRIMARY ROUTES OF EXPOSURE: Inhalation of mist or vapor. Eye and skin contact.

WARNING PROPERTIES: Irritating to eyes > 100 ppm. Not considered to have good warning properties.

HEALTH HAZARDS (ACUTE AND CHRONIC): Oral LD<sub>50</sub> for rats is 455 mg/kg. Inhalation LC<sub>50</sub> for 6 hr. for rats is 400 ppm. Chronic exposure has caused severe liver damage and possible effects to the kidneys and heart in animals. 1-NP has caused formation of methemoglobin in animal studies. Weak narcotic and respiratory irritant. No effects attributed to 1-NP have been reported in humans except eye irritation >100 ppm.

CARCINOGENICITY: Based on animal studies 2-nitropropane, a component, has been listed by IARC and NTP as a suspect carcinogen but is not listed by OSHA. Other components are not listed by NTP, IARC, or OSHA as suspect or proven carcinogens.

SIGNS & SYMPTOMS OF OVEREXPOSURE: Headache, nausea, vomiting, diarrhea, dizziness, weakness. Burning, soreness in nose, throat, or lungs.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Persons with pre-existing lung conditions may be more susceptible to irritation effects. Persons with impaired liver function may be more susceptible to effects from liver damage.

**EMERGENCY AND FIRST AID PROCEDURES:**

Eye Contact: Immediately flush with large quantities of water for at least 15 minutes while holding the eyelids open. Contact a physician immediately.

Skin Contact: Immediately remove contaminated clothing and flush area with large quantities of water for at least 15 minutes. Contact a physician if irritation develops.



Ingestion: Induce vomiting if patient is conscious. Do not induce vomiting in an unconscious patient. Contact a physician immediately.

Inhalation: Remove from contaminated atmosphere. If breathing has stopped, give artificial respiration then oxygen if needed. Contact a physician immediately.

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## SECTION SIX - REACTIVITY DATA

STABILITY: Stable.

CONDITIONS TO AVOID: High temperatures cause decomposition. Unlike nitromethane and nitroethane, no detonations of 1-NP have been reported even under very severe test conditions. However, mixing with amines, alkalies, acids, and other materials will cause 1-NP to become unstable.

INCOMPATIBILITY WITH OTHER MATERIALS: Amines, strong acids, alkalies (lye, caustic), strong oxidizers, metal oxides, hydrocarbons and other combustible materials. Lead, copper and their alloys.

HAZARDOUS DECOMPOSITION PRODUCTS: Nitrogen oxides, carbon oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID UNCONTROLLED POLYMERIZATION: N.A.

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## SECTION SEVEN - SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN TO HANDLE SPILLS OR RELEASES: Evacuate area of nonessential personnel. Ventilate area. Eliminate ignition sources. No flames, sparks or flares allowed in spill area. Vapor may collect in low areas or travel a considerable distance to ignition source and flash back. Prevent from entering drinking water supplies or streams. Collect with non-combustible absorbent material and package for disposal according to local, state, and federal regulations.

WASTE DISPOSAL PROCEDURES: When disposing of pure product as a waste according to EPA regulation 40 CFR 261 classify and label as follows:

DOT Name and Number = Waste Nitropropane, UN2608

EPA Name and Number = Ignitable, D001

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## SECTION EIGHT - SPECIAL PROTECTION INFORMATION

VENTILATION: If necessary, appropriate exhaust ventilation for the handling conditions is recommended. Dilution ventilation is not recommended as the sole control mechanism.

PROTECTIVE EQUIPMENT: Minimum - chemical safety goggles with side shields and impervious gloves. Do not wear contact lenses when handling chemicals. Wear impervious clothing if possibility of body contact exists.

RESPIRATORY PROTECTION: Use pressure-type supplied air or self-contained breathing apparatus. Do not use cartridge-type respirators.



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**SECTION NINE - SPECIAL PRECAUTIONS**

**WORK/HYGIENIC PRACTICES:** Before entering a confined space, check for vapor accumulation. Wash thoroughly after handling. Wash contaminated clothes before re-use. Launder work clothes separately from family clothes. Check protective clothing, especially impervious gloves, for leaks before use. Transfer equipment must be grounded. Do not use lye or caustic to clean drums or equipment that has contacted 1-NP. Dry salts of inorganic bases will cause 1-NP to become unstable.

**PRECAUTIONS TO BE TAKEN IN STORAGE:** Store in cool, dry, and well ventilated area. Keep containers closed. Use only DOT-approved containers. Do not enter storage area unless area is adequately ventilated. Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Nitropropane storage areas should be isolated from flammable liquids or gases. Explosives and hazardous processing should not be permitted in the vicinity of this storage area. Separate from oxidizing materials. Dry product may be stored in steel. Wet product (>2% water) must be stored in stainless steel or aluminum.

---

**SECTION TEN - REGULATORY COMMENTS**

1-Nitropropane is not a hazardous substance (40 CFR 116), toxic pollutant (40 CFR 129), or "priority pollutant" pursuant to the Federal Water Pollution Control Act, sections 311 (b)(2)(A), 307 (a).

1-Nitropropane is not a hazardous air pollutant (40 CFR 61) pursuant to the Clean Air Act, section 112.

1-Nitropropane is minimally photochemically reactive and, therefore, is classified as a solvent exempt from volume restrictions under Rule 66 of the Air Pollution Control District of Los Angeles County, Regulation 3 of the Bay Area Air Pollution Control District, or other similar pollution legislation in the United States.



**GRACE**

Organic Chemicals Division  
W.R. Grace & Co.  
55 Hayden Avenue  
Lexington, Mass. 02173

# MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 713 - 479 - 7348

## SECTION ONE - PRODUCT DESCRIPTION

IDENTITY: Nitromethane

MSDS DATE: 05-13-87

SYNONYMS: Nitrocarbinol, NM

CHEMICAL FORMULA:  $\text{CH}_3\text{NO}_2$

CAS Number: -75-52-5

TSCA LISTING: This product is listed in the TSCA inventory.

## SECTION TWO - HAZARDOUS INGREDIENTS

CHEMICAL NAME [CAS NUMBER]	PERCENT PRESENT	TLV*	PEL
Nitromethane [75-52-5]	>95	100 ppm TWA	100 ppm TWA
Nitroethane [79-24-3]	<3	100 ppm TWA	100 ppm TWA
1-Nitropropane [108-03-2]	<0.5	25 ppm TWA	25 ppm TWA
2-Nitropropane [79-46-9]	<1	10 ppm TWA	25 ppm TWA

\*Also Grace Internal Limit unless otherwise specified

N.A. = Not applicable

N.E. = None established

NAIF = No applicable information found

TLV = Threshold Limit Value  
(ACGIH guideline)

PEL = Permissible Exposure Limit  
(OSHA legal limit)

TWA = Time Weighted Average  
for 8 hrs unless otherwise specified

C = Ceiling value

LEL = Lower Explosive Limit

UEL = Upper Explosive Limit

## SECTION THREE - PHYSICAL DATA

APPEARANCE AND ODOR: Colorless liquid with mild, fruity odor.

BOILING POINT: 214°F/101°C

SPECIFIC GRAVITY: 1.139 (Water = 1)

FREEZING POINT: -20°F/-29°C

% VOLATILE BY WT.: 100

VAPOR PRESSURE: 27.8 mm Hg @ 20°C

EVAPORATION RATE: 1.8 (BuAc = 1)

VAPOR DENSITY: 2.1 (Air = 1)

WATER SOLUBILITY: 9.5% wt @ 20°C

The information contained herein is based upon data considered true and accurate. However, Grace makes no warranties, express or implied, as to the accuracy or adequacy of the information contained herein or the results to be obtained from the use thereof. This information is offered solely for the user's consideration, investigation and verification. Since the use and conditions of use of this information and the material described herein are not within the control of Grace, Grace assumes no responsibility for injury to the user or third persons. The material described herein is sold only pursuant to Grace's Terms and Conditions of Sale, including those involving warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of this data and information is in accordance with applicable federal, state or local laws and regulations.



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**SECTION FOUR - FIRE FIGHTING DATA**

NFPA Ratings (applicable to fire fighting situations only): Health -1, Flammability-3,  
Reactivity-3

FLASH POINT: 95°F/35°C

METHOD: Closed Cup

FLAMMABLE LIMIT - LEL: 7.3%

UEL: Unknown

APPROXIMATE IGNITION TEMPERATURE: 785°F/418°C

EXTINGUISHING MEDIA: Water, foam, carbon dioxide, and Halon system. Use only the Triclass type dry chemical extinguishers for classes A, B, & C. Use of other dry chemical extinguishers will cause re-ignition of the fire.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self-contained breathing apparatus. Fight fires from an explosion-resistant location. Cool drums and tanks with water spray and continue to cool after fire has been extinguished. Stay upwind and out of low areas. If tank or truck is involved in a fire, isolate for  $1/2$  mile in all directions.

UNUSUAL FIRE & EXPLOSION HAZARDS: Flammable liquid. Combustion products may contain nitrogen oxides or carbon oxides. Vapor is heavier than air and may travel a considerable distance to ignition source and flashback. Decomposes explosively at critical temperature of 599°F and critical pressure of 915 psig.

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**SECTION FIVE - HEALTH & FIRST AID DATA**

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH: 1000 ppm.

PRIMARY ROUTES OF EXPOSURE: Inhalation of mist or vapor. Eye and skin contact.

WARNING PROPERTIES: Strong >100 ppm and irritating at 200 ppm. Not considered to have good warning properties.

HEALTH HAZARDS (ACUTE AND CHRONIC): Oral LD<sub>50</sub> for rats is 1210 mg/kg. Irritating to eyes. Repeated exposure has caused mild skin irritation due to defatting effects. Animal studies produced respiratory tract irritation with breathing difficulties that may be delayed in onset. Weak narcotic. Chronic exposure of animals indicates some liver and kidney injury. No effects attributable to NM have been reported in humans.

CARCINOGENICITY: Based on animal studies 2-nitropropane, a component, has been listed by IARC and NTP as a suspect carcinogen but is not listed by OSHA. Other components are not listed by NTP, IARC, or OSHA as suspect or proven carcinogens.

SIGNS & SYMPTOMS OF OVEREXPOSURE: Weakness, incoordination, dizziness, narcosis, convulsions. Burning, soreness in nose, throat, or lungs.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Persons with pre-existing lung conditions may be more susceptible to irritation effects. Persons with impaired liver function may be more susceptible to effects caused by liver damage.

**EMERGENCY AND FIRST AID PROCEDURES:**

Eye Contact: Immediately flush with large quantities of water for at least 15 minutes while holding the eyelids open. Contact a physician immediately.

Skin Contact: Immediately remove contaminated clothing and flush area with large quantities of water for at least 15 minutes. Contact a physician if irritation develops.



Ingestion: Induce vomiting if patient is conscious. Do not induce vomiting in an unconscious patient. Contact a physician immediately.

Inhalation: Remove from contaminated atmosphere. If breathing has stopped, give artificial respiration then oxygen if needed. Contact a physician immediately. Effects of inhalation overexposure may not be immediately obvious.

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#### SECTION SIX - REACTIVITY DATA

STABILITY: Stable at normal temperatures and pressures. Unstable at elevated temperatures and pressure.

CONDITIONS TO AVOID: Decomposes explosively at critical temperature of 599°F and critical pressure of 915 psig. Can be detonated by shock from high explosives, or by heat if under strong confinement. Mixing with amines, acids, or certain other chemical compounds will cause NM to become more sensitive to detonation.

INCOMPATIBILITY WITH OTHER MATERIALS: Amines, strong acids, alkalies (lye, caustic), strong oxidizers, metal oxides, hydrocarbons, and other combustible materials. Lead, copper, and their alloys.

HAZARDOUS DECOMPOSITION PRODUCTS: Nitrogen oxides, carbon oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID UNCONTROLLED POLYMERIZATION: N.A.

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#### SECTION SEVEN - SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN TO HANDLE SPILLS OR RELEASES: Evacuate area of nonessential personnel. Ventilate area. Eliminate ignition sources. No flames, sparks or flares allowed in spill area. Vapor may collect in low areas or travel a considerable distance to ignition source and flash back. Prevent from entering drinking water supplies or streams. Collect with non-combustible absorbent material and package for disposal according to local, state, and federal regulations.

WASTE DISPOSAL PROCEDURES: When disposing of pure product as a waste according to EPA regulation 40 CFR 261 classify and label as follows:

DOT Name and Number = Waste Nitromethane, UN1261

EPA Name and Number = Ignitable, D001

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#### SECTION EIGHT - SPECIAL PROTECTION INFORMATION

VENTILATION: If necessary, appropriate explosion-proof exhaust ventilation for the handling conditions is recommended. Dilution ventilation is not recommended as the sole control mechanism.

PROTECTIVE EQUIPMENT: Minimum - chemical safety goggles with side shields and impervious gloves. Do not wear contact lenses when handling chemicals. Wear impervious clothing if possibility of body contact exists.



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**RESPIRATORY PROTECTION:** Use pressure-type full-face supplied air or self-contained breathing apparatus. Do not use cartridge-type respirators.

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## SECTION NINE - SPECIAL PRECAUTIONS

**WORK/HYGIENIC PRACTICES:** Before entering a confined space, check for vapor accumulation. Wash thoroughly after handling. Wash contaminated clothes before re-use. Launder work clothes separately from family clothes. Check protective clothing, especially impervious gloves, for leaks before use. Transfer equipment must be grounded. Do not use lye or caustic to clean drums or equipment that has contacted NM. Dry salts of inorganic bases and NM are explosive.

**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:** Store in cool, dry, and well ventilated area. Keep containers closed to maintain nitrogen blanket. Use only DOT-approved containers. Do not enter storage area unless area is adequately ventilated. Protect against physical damage. Nitromethane should be stored in a suitably isolated outdoor storage facility. Because of the explosion potential presented, every possible means should be taken to protect the storage area from exposure to external fires. Explosives and hazardous processing should not be permitted in the vicinity of the storage areas. Separate from oxidizing materials. Dry product may be stored in steel. Wet product (>0.2% water) must be stored in stainless steel or aluminum.

---

## SECTION TEN - REGULATORY COMMENTS

Nitromethane is not a hazardous substance (40 CFR 116), toxic pollutant (40 CFR 129), or "priority pollutant" pursuant to the Federal Water Pollution Control Act, sections 311 (b)(2)(A), 307 (a).

Nitromethane is not a hazardous air pollutant (40 CFR 61) pursuant to the Clean Air Act, section 112.

Nitromethane is minimally photochemically reactive and, therefore, is classified as a solvent exempt from volume restrictions under Rule 66 of the Air Pollution Control District of Los Angeles County, Regulation 3 of the Bay Area Air Pollution Control District, or other similar pollution legislation in the United States.



**GRACE**

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# MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 603 - 888 - 2320

Page: 1 of 3

**SECTION ONE - PRODUCT DESCRIPTION**

IDENTITY: AMP-95  
EXPERIMENTAL PRODUCT

MSDS DATE: 09-01-87

CHEMICAL DESCRIPTION: 1-Propanol, 2-amino-2-methyl-  
SYNONYMS: Isobutanol-2-amine

CAS Number: 124-68-5  
TSCA LISTING: This product is listed in the TSCA inventory.

**SECTION TWO - HAZARDOUS INGREDIENTS**

CHEMICAL NAME [CAS NUMBER]	PERCENT PRESENT	TLV*	PEL
AMP-95 [124-68-5]	~95 %	N.E.	N.E.

\*Also Grace Internal Limit unless otherwise specified

N.A. = Not applicable

NAIF = No applicable information found

TLV = Threshold Limit Value

(ACGIH guideline)

TWA = Time Weighted Average

for 8 hrs unless otherwise specified

LEL = Lower Explosive Limit

N.E. = None established

N.D. = Not determined

PEL = Permissible Exposure Limit

(OSHA legal limit)

C = Ceiling value

UEL = Upper Explosive Limit

**SECTION THREE - PHYSICAL DATA**

APPEARANCE AND ODOR: Colorless liquid with a faint, fishy odor.

BOILING POINT: ~ same as water

MELTING POINT: N.A.

VAPOR PRESSURE: ~ same as water

VAPOR DENSITY: ~ same as water

WATER SOLUBILITY: Completely miscible

SPECIFIC GRAVITY: 0.94

% VOLATILE BY WT.: 5% as water

EVAPORATION RATE: ~ same as water

pH of 1% Solution: 13.0

**SECTION FOUR - FIRE FIGHTING DATA**

FLASH POINT: &gt;200°F -aqueous

FLAMMABLE LIMIT - LEL: N.D.

METHOD: N.D.

UEL: N.D.

The information contained herein is based upon data considered true and accurate. However, Grace makes no warranties, express or implied, as to the accuracy or adequacy of the information contained herein or the results to be obtained from the use thereof. This information is offered solely for the user's consideration, investigation and verification. Since the use and conditions of use of this information and the material described herein are not within the control of Grace, Grace assumes no responsibility for injury to the user or third persons. The material described herein is sold only pursuant to Grace's Terms and Conditions of Sale, including those limiting warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of this data and information is in accordance with applicable federal, state or local laws and regulations.



EXTINGUISHING MEDIA: Water, dry chemical, carbon dioxide, foam.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self contained breathing apparatus with full face-piece. Use water spray to cool fire-exposed containers.

UNUSUAL FIRE & EXPLOSION HAZARDS: None.

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## SECTION FIVE - HEALTH & FIRST AID DATA

PRIMARY ROUTES OF EXPOSURE: Eye and skin contact. Inhalation exposure is not likely unless material is heated.

HEALTH HAZARDS (ACUTE AND CHRONIC): Oral LD<sub>50</sub> for rats is 2300 mg/kg expected to be slightly toxic by ingestion. Due to pH may be irritating to eyes and skin. Inhalation of heated vapor or a mist may be irritating to the respiratory tract.

CARCINOGENICITY: This material is not listed by NTP, IARC, or OSHA as a suspect or proven carcinogen. There is no evidence that indicates the material may be carcinogenic to humans or animals.

SIGNS & SYMPTOMS OF OVEREXPOSURE: Redness, burning, tearing of eyes. Red, swollen, or inflamed skin. Coughing, wheezing, chest tightness.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Persons with pre-existing skin or lung disorders may be more susceptible to the irritating properties of the material.

### EMERGENCY AND FIRST AID PROCEDURES:

Eye Contact: Immediately flush with large quantities of water for at least 15 minutes while holding the eyelids open. Do not attempt to neutralize with chemical agents. Contact a physician immediately.

Skin Contact: Immediately remove contaminated clothing and flush area with large quantities of water for at least 15 minutes. Do not attempt to neutralize with chemical agents. Contact a physician immediately.

Ingestion: If conscious, give large quantities of water to drink. Do not induce vomiting. Do not give an unconscious person anything by mouth. Contact a physician immediately.

Inhalation: Remove from contaminated atmosphere. If breathing has stopped, give artificial respiration then oxygen if needed. Contact a physician immediately.

---

## SECTION SIX - REACTIVITY DATA

STABILITY: Stable.

CONDITIONS TO AVOID: N.A.

INCOMPATIBILITY WITH OTHER MATERIALS: Oxidizing materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, carbon dioxide, nitrogen oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID UNCONTROLLED POLYMERIZATION: N.A.



---

**SECTION SEVEN - SPILL & DISPOSAL PROCEDURES**

**STEPS TO BE TAKEN TO HANDLE SPILLS OR RELEASES:** Evacuate area of nonessential personnel. Ventilate area. Prevent from entering drinking water supplies or streams. Collect with absorbent material and package for disposal according to local, state, and federal regulations.

**WASTE DISPOSAL PROCEDURES:** Check the as is pH. If above 12.5 classify and label as follows:

EPA Name: Corrosive.....No. = D002

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**SECTION EIGHT - SPECIAL PROTECTION INFORMATION**

**VENTILATION:** If necessary, appropriate exhaust ventilation for the handling conditions is recommended. Dilution ventilation is not recommended as the sole control mechanism.

**PROTECTIVE EQUIPMENT:** Minimum - chemical safety goggles with side shields and impervious gloves. Do not wear contact lenses when handling chemicals. Wear impervious clothing if possibility of body contact exists.

**RESPIRATORY PROTECTION:** Use an approved organic vapor respirator within use limitations. In all other situations use self-contained breathing apparatus.

---

**SECTION NINE - SPECIAL PRECAUTIONS**

**WORK/HYGIENIC PRACTICES:** Wash thoroughly after handling. Wash contaminated clothes before re-use. Launder work clothes separately from family clothes. Check protective clothing, especially impervious gloves, for leaks before use.

**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:** Do not store near oxidizing materials. Store in cool, dry, and well ventilated area. Keep containers closed. Use only DOT-approved containers. Do not enter storage area unless area is adequately ventilated.



### General Process Descriptions for Nitroparaffin Derivatives

Three products will be manufactured which basically use the same raw materials except for a change in the nitroparaffin. The first product, Tris (hydroxymethyl) aminomethane (TA), uses nitromethane; 2-amino-butanol (2AB) uses 1-nitropropane; and 2-amino-2-methyl-propanol (AMP) uses 2-nitropropane.

A nitroparaffin is reacted with formaldehyde followed by water removal. The resulting nitro intermediate is reduced by catalytic hydrogenation. Catalyst is then removed.

In the case of TA, product is crystallized from solution, centrifuged, and dried in a rotary, vacuum drier. In 2AB and AMP, products are concentrated by distillation.

Block flowsheets illustrating the above process are attached. Additional detailed process descriptions are given under a separate cover with confidential labeling.

Solvents used in the process will be recovered in the process by distillation and recycle. All major tanks and reactors are vented to a common scrubber capable of removing amines and VOCs from the vent stream. Vent condensers are present on the reactors prior to the scrubber. Tanks not vented to the scrubber are equipped with flame arrestors and conservation vents. All centrifugal pumps have double mechanical seals. Some pumps are canned pumps with no seals.

Material safety data information and specific information on the nitroparaffins is also attached.

May 9, 1989  
J.E. Porter



## PROCESS DESCRIPTIONS

### Tris (hydroxymehtyl) Aminomethane (TA) and Tris (hydroxymehtyl) nitromethane (TN)

A nitroalcohol intermediate is produced by a condensation reaction. The intermediate TN may be removed as product after water removal, and carbon treatment for color removal. To produce TA, TN is hydrogenated followed by ion exchange, carbon treatment, crystallization, centrifugation, and drying.

### 2-Amino-Butanol (2AB)

This amino alcohol is manufactured from 1-nitopropane using most of the same processes as TA, and consequently the same equipment. The exception is the last step of product separation. Instead of crystallization and drying, 2AB is distilled to obtain purity

### 2-Amino-2-methyl-propanol (AMP)

2-Nitopropane is the main raw material for the third product and follows the same manufacturing steps as 2AB.

Ancillary steps in the manufacturing process which generate waste include regeneration of the ion exchange resins, washing of the carbon columns, and solvent recovery. All waste streams from the process will be transported to an appropriate off-site facility for disposal. The wastes will be evaluated for their compatibility with our on-site biological treatment system and will be handled there should it be practical.

There are other products in this series of nitroparaffin derivatives which will be incorporated into this operation at a later date. The general chemistry varies little from these products. The Department will be informed of these products as they are planned for introduction into the manufacturing schedule.



CYPERMETHRIN PROCESS DESCRIPTION (REVISED 10/79 JEP)  
-REFERENCE FIGURE 4

THE HYDROLYSIS, ACIDIFICATION AND EXTRACTION STEPS ARE IDENTICAL TO THE PERMETHRIN PROCESS WITH THE EXCEPTION THAT ONLY TWO CYCLES THROUGH R-1 AND R-2 CONSTITUTE AN R-6, R-4 BATCH AND THAT R-3 IS NOT USED IN THE ACID CHLORIDE FORMATION STEP. ALL VESSELS WILL VENT TO C-PE101, CAUSTIC SCRUBBER.

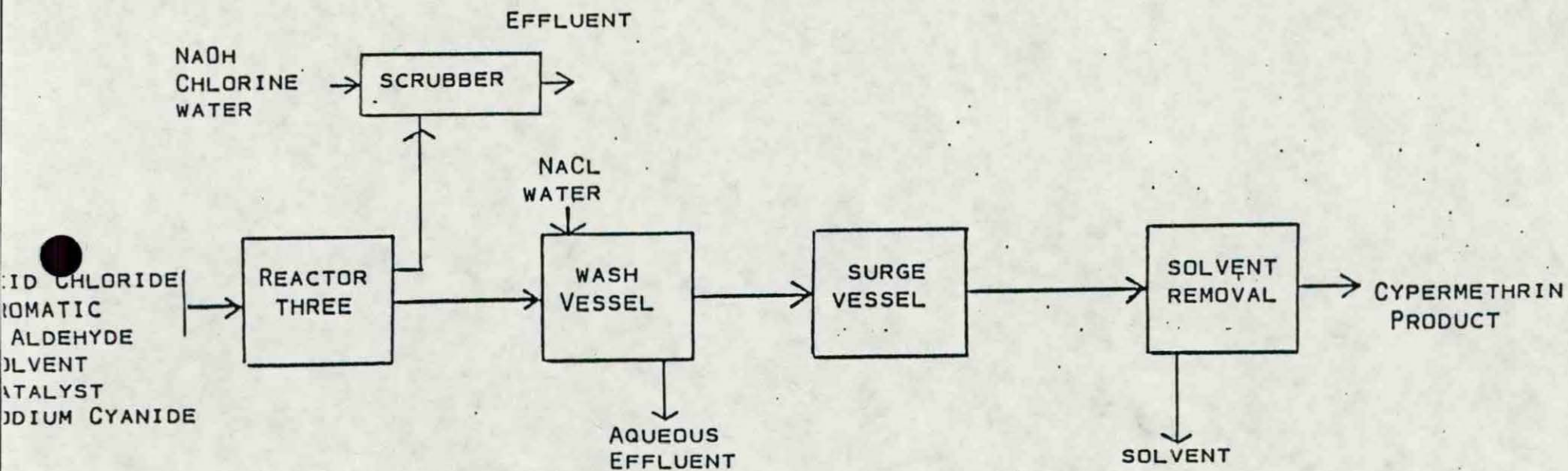
PREMIX AND CYANIDE REACTION

ACID CHLORIDE FROM R-4 IS MIXED WITH PHENOXYBENZALDEHYDE IN R-PE108, WHILE SODIUM CYANIDE IS MIXED IN WATER IN R-PE103. THE REACTION TAKES PLACE AS THE PREMIX OF ACID CHLORIDE AND ALDEHYDE ARE FED INTO THE CYANIDE SOLUTION. THE MATERIAL IS THEN WASHED IN R-PE105.

THE FINAL PRODUCT IS THEN TAKEN TO R-PE107 FOR SOLVENT REMOVAL TO AN APPROXIMATE 50% SOLUTION OF TECHNICAL MATERIAL. ALL VESSELS FROM R-4 ON ARE VENTED TO C-PE402, A SCRUBBER SYSTEM FED WITH CAUSTIC HYPOCHLORITE FOR CYANIDE DESTRUCTION. ALL WASHES CONTAINING CYANIDE ARE MIXED WITH HYPOCHLORITE TO ASSURE CYANIDE DESTRUCTION. WASTE STREAMS FROM THIS PORTION OF THE PROCESS ARE NOT MIXED WITH NEUTRALIZED WASTE STREAMS FROM THE ACID CHLORIDE FORMATION STEPS.



VERTAC CHEMICAL CORPORATION  
WEST HELENA, ARKANSAS  
JANUARY 11, 1983



PROCESS: CYPERMETHRIN, TECHNICAL  
MANUFACTURED FOR: ICI AMERICAS

## Vertac Chemical Corporation - West Helena Plant

## Hazardous Assessment Report for Waste Materials

Sample ID.: CAUSTIC SCRUBBER LIQUORDate of Report: 7/23/84Date Sampled: 7/23/84Source of sample: FIRST CHEMICAL CORPORATION

## Physical Characteristics

Color Yellow cloudy LIQUIDOdor: None                      Mild ✓ Strong                     

Physical state @ 70 F:

Solid                      Semi-solid                      Liquid ✓

Layers:

Multi-layered                      Bi-layered                     Single-phased ✓

Free liquids

Yes                      No                      Per cent                     pH 12.5Specific gravity 1.178Flash point >200°F

## Chemical Composition

Compound	Per cent
1. <u>NITROBENZENE</u>	<u>448 ppm</u>
2. <u>M-CHLORO NITRO BENZENE</u>	<u>145 ppm</u>
3. <u>Sodium Chloride</u>	<u>14 %</u>
4. <u>Sodium hypochlorite</u>	<u>6.3 %</u>
5. <u>Sodium hydroxide</u>	<u>1.4 %</u>
6. <u>                                    </u>	<u>                                    </u>
7. <u>                                    </u>	<u>                                    </u>
8. <u>                                    </u>	<u>                                    </u>
9. <u>                                    </u>	<u>                                    </u>
10. <u>                                    </u>	<u>                                    </u>



## Vertac Chemical Corporation - West Helena Plant

## Hazards Assessment Report for Waste Materials

Sample ID.: Chloro Nitrobenzene Waste WaterDate of Report: 7/18/84 Date Sampled: 7/17/84Source of sample: First Chemical Corporation

## Physical Characteristics

Color: yellow liquidOdor: None                      Mild ✓ Strong                     

Physical state @ 70 F:

Solid                      Semi-solid                      Liquid ✓

Layers:

Multi-layered                      Bi-layered                     Single-phased ✓

Free liquids

Yes                      No                      Per cent                     pH 2.1Specific gravity 1.002Flash point >200°F

## Chemical Composition

Compound	Per cent
1. <u>NITROBENZENE</u>	<u>1795 ppm</u>
2. <u>Chloro Nitro Benzene</u>	<u>380 ppm</u>
3. <u>Ferric Chloride</u>	
4. <u>                    </u>	
5. <u>                    </u>	
6. <u>                    </u>	
7. <u>                    </u>	
8. <u>                    </u>	
9. <u>                    </u>	
10. <u>                    </u>	

~~HELWA~~ CHEMICAL  
West. Helwa, Ark

1. INSECTICIDES

- A. ALDRIN
- B. BIDRIN
- C. CHLORDANE
- D. DASANIT
- E. DIELDRIN
- F. DI-SYSTON
- G. DDT
- H. ENDRIN
- I. EPN
- J. ETHYL PARATHION
- K. MALATHION
- L. METHYL PARATHION
- M. PHOSDRIN
- N. TDE
- O. TOXAPHENE

2. HERBICIDES

- A. ATRAZINE
- B. DACTHAL
- C. DINITRO
- E. DIURON
- F. DSMA
- G. HERBAN
- H. LOROX
- I. MSMA

3. MISC.

- A. DEF
- B. DACONIL
- C. NEMAGON

Joe  
—



## DESCRIPTION OF PROCESS

## PROCESS 1: PROPANIL HERBICIDE

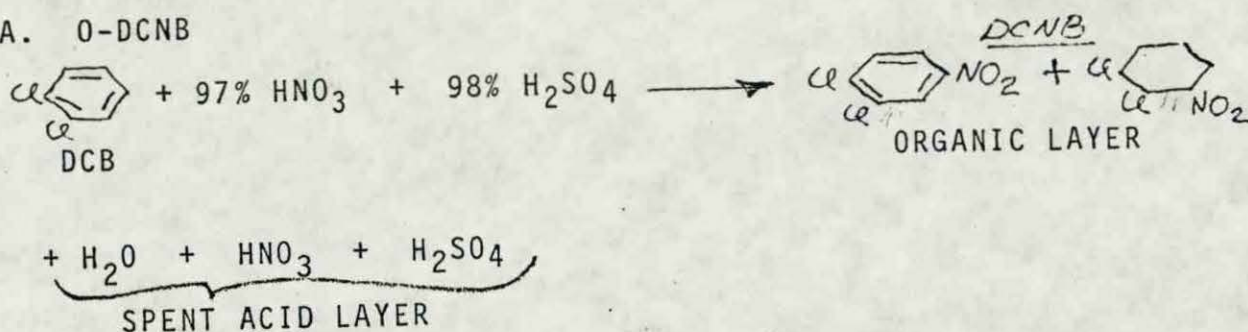
1-800-424-9346

## I. INTRODUCTION

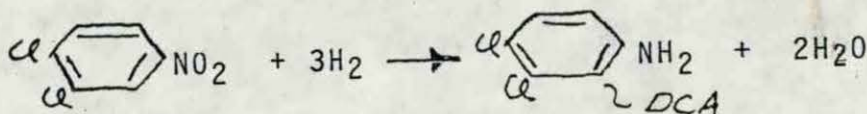
Propanil is the end product of a series of reactions. Ortho-Dichlorobenzene (DCB) undergoes a nitration step to make O-Dichloronitrobenzene (O-DCNB). The O-DCNB is reacted with hydrogen under pressure in the presence of a catalyst to produce dichloroaniline (DCA). DCA is then reacted with propionic acid to produce Propanil.

## II. REACTIONS (SEE FLOW DIAGRAMS)

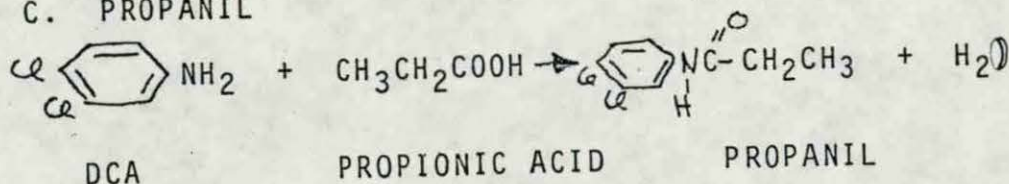
## A. O-DCNB



## B. DCA



## C. PROPANIL



## III. PROCESS FLOW DESCRIPTIONS

## A. O-DCNB (SEE FLOW DIAGRAM)

DCB (Stream 1) is added to the DCNB reactor, a 1500 gallon glass lined steel reactor. Mixed acid (Stream 2) consisting of 98% sulfuric & 97% nitric acid is added to reactor to form dichloronitrobenzene (DCNB). Dilution water is added to enhance phase separation & the lower spent acid phase (Stream 4) is decanted to a storage tank. Next aqua ammonia (Stream 3) is added to the reactor to neutralize residual sulfuric acid in the DCNB layer. The resulting aqueous ammonium sulfate (Stream 5) is drained to a storage tank. Both by products are hauled



offsite for recycle or disposal. DCNB product (Stream 6) is transferred to the DCA step. A vent line is provided for R-3 as a safety precaution for this type reaction, a nitration. There is no normal vent emission as such. Small quantities of raw materials & DCNB (& DCA) would be present in the atmosphere as a result of this process but not as a point source emissions.

B. DCA (SEE FLOW DIAGRAM)

O-DCNB (Stream 6) is reacted with gaseous  $H_2$  (Stream 8) under pressure in the presence of a catalyst. The catalyst is recovered by filtration. The DCA reactor is a 2000 gal. Stainless Steel clad autoclave. The resulting product DCA (Stream 8) is transferred to the Propanil Step.

C. PROPANIL (SEE FLOW DIAGRAM)

DCA (Stream 8) is charge to R-1 from the DCA reactor or from DCA storage. R-1 is a pressure rated 2000 gal. stainless steel stirred reactor. Propionic acid (Stream 9) is charged from storage and from recycle recovered propionic from the previous batch. This first charge of propionic acid is not sufficient to complete the reaction, because the reaction generates water. Propionic anhydride (Stream 10) is added to soak up the water of reaction. The reaction mixture is dissolved in an organic solvent, mesityl oxide (stream 11) and the water of reaction is removed by distillation representing propionic acid for recycle (Stream 13). The excess propionic acid is then removed by vacuum (ejector) distillation representing propionic acid for disposal (Stream 12). Following final adjustment in solvent, finished Propanil 4 lb. formulation is produced (Stream 14).

Vents associated with the distillation of propionic acid for recycle & vacuum distillation for disposal are routed to a covered sump where material is recovered primarily as a liquid for effluent disposal. Small quantities of raw materials & propanil would be present in the atmosphere as a result of this process but not as point source emissions.



### DCNB MATERIAL BALANCE

IN	
①	DCB 281 lbs/hr
	-O-Dichlorobenzene- 280 lbs/hr
	-related organics 1 lbs/hr
②	MIXED ACID 603 lbs/hr
	Nitric Acid 122 lbs/hr
	Sulfuric Acid 477 lbs/hr
	H2O 4 lbs/hr
③	AQUA AMMONIA 82 lbs/hr
	NH3 .6 lbs/hr
	H2O 81.5 lbs/hr

IN TOTAL 966 lbs/hr

### DCA MATERIAL BALANCE

IN	
⑦	HYDROGEN GAS 11 lbs/hr
⑥	DCNB FEED 360 lbs/hr

### BY PRODUCT

OUT	
④	SPENT ACID 602 lbs/hr
	-Sulfuric Acid
	-Nitric Acid 475 lbs/hr
	-H2O *119 lbs/hr
	-related organics 8 lbs/hr
⑤	BY PRODUCT 84 lbs/hr
	Am. sulfate 2.4 lbs/hr
	H2O 81.5 lbs/hr
⑥	DCNB PRODUCT 360 lbs/hr
	-2,3 Dichloroaniline 29 lbs/hr
	-3,4 Dichloronitrobenzene 330 lbs/hr
	-related organics 1 lb/hr

OUT TOTAL \*1046 lbs/hr

OUT	
⑧	DCA PRODUCT 371 lbs/hr
	-2,3 Dichloroaniline 273 lbs/hr
	-related organics 31 lbs/hr
	-H2O 24% 67 lbs/hr

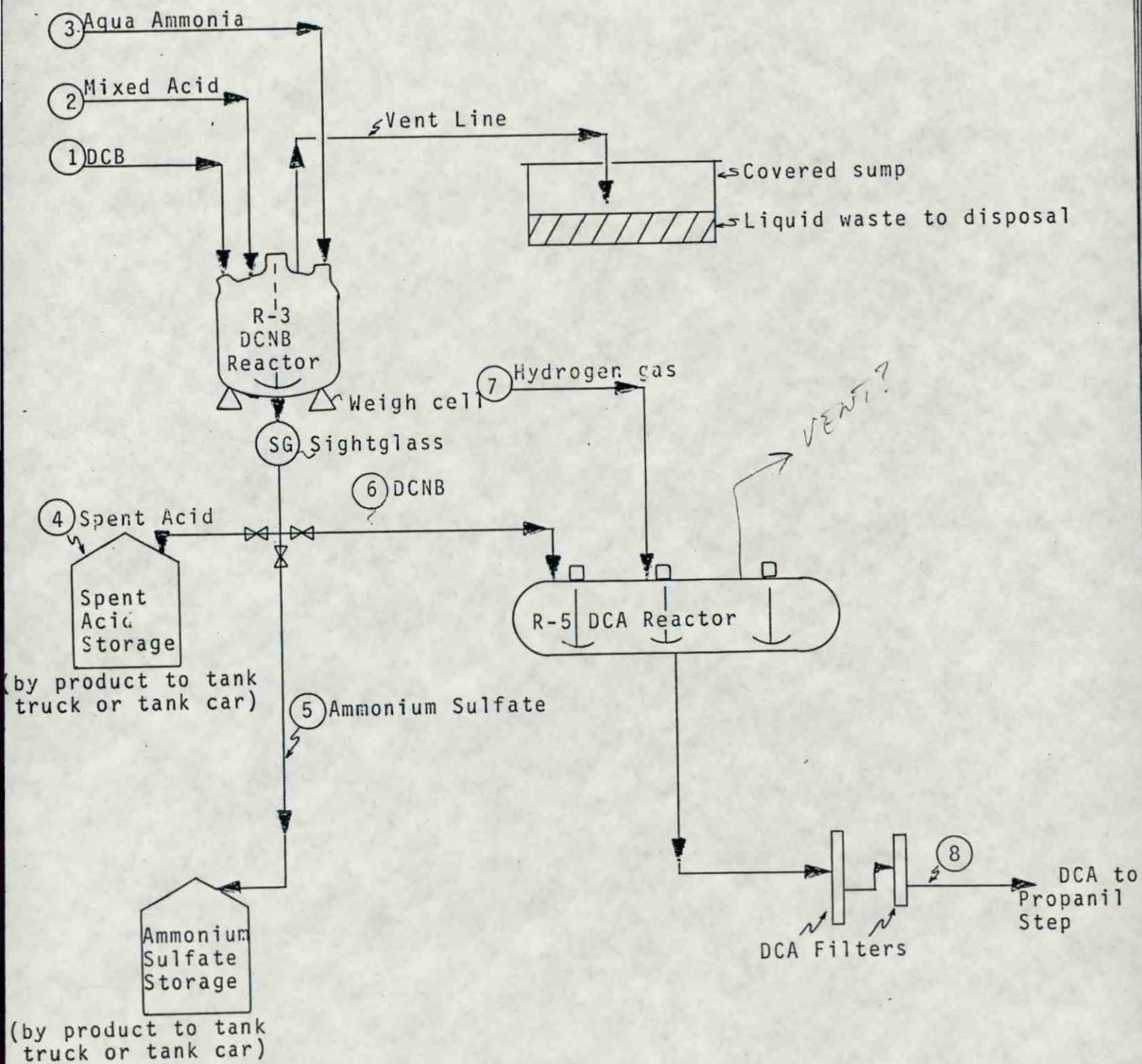
\* Includes ~ 80 lbs/hr spent acid dilution water

BATCH OPERATION = 20 hr. Batch cycle time

## PROCESS FLOW DIAGRAM &amp; MATERIAL BALANCE

## Process 1: Propanil Herbicide

## -DCNB &amp; DCA STEPS-





## PROPANIL MATERIAL BALANCE

IN

- ⑧ DCA 700 lb/hr  
(purchased or manufactured  
in R-5)  
-2,3 dichloroaniline  
→ 585 lb/hr  
-related organics 65 lb/hr  
-H<sub>2</sub>O 8% 50 lb/hr
- ⑨ PROPIONIC ACID 400 lbs/hr  
(Fresh & Recycle)  
-Propionic Acid 386 lbs/hr  
-H<sub>2</sub>O 14 lbs/hr
- ⑩ PROPIONIC ANHYDRIDE 56 lbs/hr
- ⑪ MESITYL OXIDE  
SOLVENT 676 lbs/hr

IN TOTAL

1832 lbs/hr

OUT

- ⑫ CONDENSATE TO DISPOSAL 229 lb/hr  
-Propionic Acid 101 lb/hr  
-H<sub>2</sub>O 128 lb/hr
- ⑬ CONDENSATE TO RECYCLE 67 lb/hr  
-Propionic Acid 50 lb/hr  
-H<sub>2</sub>O 17 lb/hr
- ⑭ PROPANIL 4 LB FORMULATION 1536 lb/hr  
-Propanil 787 lb/hr  
-DCA 1 lb/hr  
-Propionic Acid 1 lb/hr  
-tars 71 lb/hr  
-Mesityl Oxide 676 lb/hr

OUT TOTAL

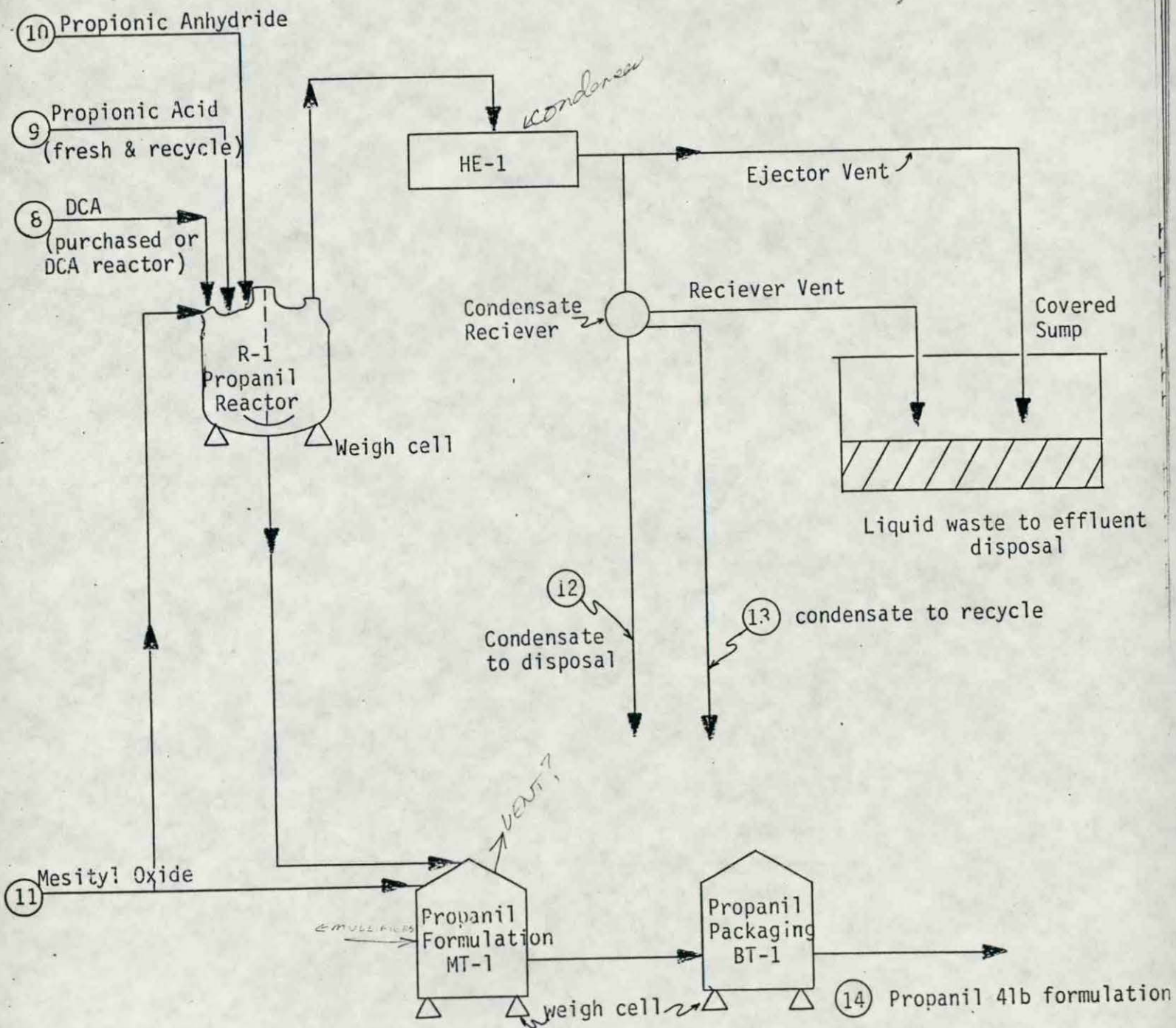
1832 lb/hr

BATCH OPERATION = 18 HR BATCH CYCLE TIME

# PROCESS FLOW DIAGRAM & MATERIAL BALANCE

## PROCESS 1 - PROPANIL HERBICIDE

*DIFFERENCE IN DCA + DCA STEP*





## MATERIAL IDENTIFICATION

NUMBER : 1086CR  
NAME : p-Nitrotoluene  
  
GRADE : Flaked, Cast Solid, and Molten Technical  
CHEMICAL FAMILY : Aromatic Nitro  
TRADE NAMES AND SYNONYMS :  
PNT  
Paranitrotoluol  
4-Methylnitrobenzene  
  
CAS NAME : Benzene, 1-methyl-4-nitro  
CAS NUMBER : 99-99-0  
FORMULA : CH<sub>3</sub>C<sub>6</sub>H<sub>4</sub>NO<sub>2</sub>  
MANUFACTURER/DISTRIBUTOR: E.I. du Pont de Nemours & Co., Inc.  
1007 Market Street  
Wilmington, DE 19898  
  
PRODUCT INFORMATION PHONE : 1-(800)441-7515  
TRANSPORTATION EMERGENCY PHONE : 1-(800)424-9300  
MEDICAL EMERGENCY PHONE : 1-(800)441-3637

\*\*\*\*\*  
COMPONENTS

Material	CAS Number	%
p-Nitrotoluene	99-99-0	99.5

\*\*\*\*\*

## PHYSICAL DATA

Boiling Point : 238 deg C at 760 mm Hg. (460 F)  
Vapor Density : 4.7 (Air = 1.0)  
Melting Point : 52 deg C (125 F)  
Evaporation Rate : < 1  
Solubility in Water : 0.04 WT % at 30 deg C  
Odor : Aromatic nitro  
Form : Solid or molten  
Color : Light yellow  
Specific Gravity : 1.139 at 55 deg C  
Vapor Pressure : 5 mmHg @ 85 C  
40 mmHg @ 136 C  
  
pH Information : 6.6 (water extract)  
Appearance : Flakes; crystalline solid; oily liquid *solid at T = 20 °C*

\*\*\*\*\*  
HAZARDOUS REACTIVITY

Incompatibility : Incompatible with strong oxidizers, sulfuric acid, or reducing agents.  
Decomposition : See Instability. Releases hazardous oxide of nitrogen gases.  
Polymerization : Polymerization will not occur.



## (HAZARDOUS REACTIVITY - CONTINUED)

Instability : Stable at normal temperatures and conditions of storage. Decomposes slowly at 200 C (392 F). Temperatures above 220 C (428 F) are normally required to initiate rapid exothermic decomposition but foreign matter may lower the decomposition temperature substantially.

\*\*\*\*\*  
FIRE AND EXPLOSION DATA

Flash Point : 106 deg C  
Method : SFCC  
Flammable Limits in Air, % by Vol.  
LEL : 1.6  
UEL : Not determined  
Autoignition Temperature : 390 deg C  
Autodecomposition Temp: 200 C, (See Instability)

## FIRE AND EXPLOSION HAZARDS

OSHA Class III B Combustible Liquid. May decompose exothermically at high temperatures.

## EXTINGUISHING MEDIA

Small fires: Dry chemical or carbon dioxide (CO2)  
Large fires: Water spray, fog, or foam

## SPECIAL FIRE FIGHTING INSTRUCTIONS

Evacuate area. Stay upwind; avoid smoke and fumes. Use water spray to cool tanks and reduce vapors. If smoke and fumes cannot be avoided, wear chemical-proof suit with hood and breathing air supply. Fight fire from maximum distance. Use care when approaching advanced or massive fire. Product may decompose from heat and rupture container.

\*\*\*\*\*  
HEALTH HAZARD INFORMATION

Harmful if inhaled or absorbed through skin; reduced blood's oxygen carrying capacity. Symptoms may be delayed.

Inhalation 1-hour ALC: >41 ppm in rats  
Skin absorption ALD: >200 mg/kg in rabbits  
Oral LD50: 2144 mg/kg in rats

Toxic effects described in animals from short exposures include methemoglobinemia, anemia, and nonspecific effects such as weight loss and and irritation. Tests for mutagenic activity in bacterial or mammalian cell cultures have been



## (HEALTH HAZARD INFORMATION - CONTINUED)

inconclusive, with positive results in some studies, and negative results in others.

Human health effects of overexposure may initially include: reduction of the blood's oxygen carrying capacity with cyanosis (bluish discoloration), weakness, or shortness of breath by formation of methemoglobin; abnormal blood forming system function with anemia; or red blood cell destruction. There are no reports of human sensitization. Individuals with preexisting diseases of the cardiovascular system or bone marrow may have increases susceptibility to the toxicity of excessive exposures.

## Carcinogenicity

None of the components in this chemical is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

## Exposure Limits for p-Nitrotoluene

TLV \* (ACGIH) : See Below

PEL (OSHA) : See Below

\* TLV is a registered trademark.

## Other Applicable Exposure Limits:

OSHA 8-hour Time Weighted Average (TWA) = 5 ppm or 30 mg/m<sup>3</sup>, ACGIH "TLV"-TWA = 2 ppm or 11 mg/m<sup>3</sup> for all isomers of Nitrotoluene. Both limits have "SKIN" notation indicating that liquid and vapor are capable of penetrating skin and mucous membrane. Control of vapor inhalation alone may not be sufficient to prevent absorption of an excessive dose.

## Safety Precautions

Avoid breathing vapors or mist. Avoid contact with eyes. Avoid contact with skin. Avoid contact with clothing. Wash thoroughly after handling.

\*\*\*\*\*

## FIRST AID

If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse and destroy contaminated shoes.



## (FIRST AID - CONTINUED)

If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Call a physician. Never give anything by mouth to an unconscious person.

NOTE TO PHYSICIAN: Absorption of this product into the body leads to the formation of methemoglobin which, in sufficient concentration, causes cyanosis. In case of skin absorption, symptoms may be delayed. Since reversion of methemoglobin to hemoglobin occurs spontaneously after termination of exposure, moderate degrees of cyanosis need be treated only by supportive measures such as bed rest and oxygen inhalation. Thorough cleansing of the entire contaminated area of the body including scalp and nails is of utmost importance. If cyanosis is severe, intravenous injection of methylene blue, 1 mg/kg of body weight, may be of value. Cyanocobalamin (Vitamin B-12), 1 mg intramuscularly, will speed recovery. Intravenous fluids and blood transfusions may be indicated in very severe exposures.

\*\*\*\*\*  
PROTECTION INFORMATION

## Generally Applicable Control Measures and Procedures

Good general ventilation should be provided to keep vapor concentrations below exposure limits.

## Personal Protective Equipment

Eye/Face : Coverall chemical splash goggles. Safety glasses (side shield pref.); full-length face shield

Respirator : Air supplied respirator. with hood and chemical-proof suit if direct exposure likely.

Additional : Protective footwear. hard hat w/brim, butyl rubber pants, jacket, apron

Protective Gloves : Neoprene for routine work, Butyl rubber for liquid contact

\*\*\*\*\*  
DISPOSAL INFORMATION

## Spill, Leak, or Release

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.

Evacuate area and keep upwind of spill. Contain spill with sand or earth dam, allow to freeze and transfer to a covered metal container for disposal. Flush area with detergent and water. Wear appropriate protective equipment. Comply with Federal, State, and local regulations on reporting releases.



## (DISPOSAL INFORMATION - CONTINUED)

## Waste Disposal

Comply w/Fed., St. & loc. reg. If approved may be incinerated, sent to an approved hazardous material disposal area, or transferred to a disposal contractor. Very dilute solutions are biodegradable by specially acclimated bacteria.

\*\*\*\*\*  
SHIPPING INFORMATION

## DOT

Proper Shipping Name :  
Nitrotoluene\*  
Hazard Class : ORM-E  
UN/NA No. : 1664  
Special Information : \*Not regulated by DOT in containers of less than 1000 lbs.

## DOT/IMO

Proper Shipping Name :  
Nitrotoluenes  
Hazard Class : Poison B, 6.1  
UN No. : 1664  
DOT/IMO Label : Poison  
Special Information : Flash Point: 106 C (223 F)

Reportable Quantity : 1000 lbs.

## Shipping Containers

Tank cars, tank trucks, drums

\*\*\*\*\*  
STORAGE CONDITIONS

Store in well ventilated area. Keep container tightly closed.  
Store in a dry area away from heat, sparks, and flame.  
Handle in a manner to prevent human contact.

\*\*\*\*\*  
ADDITIONAL INFORMATION AND REFERENCES

For further information, see Du Pont "p-Nitrotoluene, Technical" Data Sheet.

TSCA Inventory Status: Reported/Included

## NPCA-HMIS RATINGS

Health (Acute) 2  
Flammability 1  
Reactivity 1  
Personal Protection -

## NFPA RATINGS

Health 3  
Flammability 1  
Reactivity 0  
Unusual Hazards

28-Apr-89

Du Pont Material Safety Data Sheet

6

MSDS No: 1086CR

(ADDITIONAL INFORMATION AND REFERENCES - CONTINUED)

Personal Protection Rating to  
be supplied by user depending  
on use conditions.

\*\*\*\*\*

The data in this Material Safety Data Sheet relates only to the  
specific material designated herein and does not relate to use in  
combination with any other material or in any process.

Date of latest Revision : 87/06/23  
Responsibility for MSDS : J. C. Watts  
Chestnut Run Site, C&P Dept.  
Wilmington, DE 19898  
302-999-4946



STATE OF ARKANSAS  
DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY

8001 NATIONAL DRIVE, P.O. BOX 9583  
LITTLE ROCK, ARKANSAS 72209

PHONE: (501) 562-7444

August 4, 1988

Mr. Joe Porter  
Cedar Chemical Corporation  
P.O. Box 2749  
West Helena, Arkansas 72390

Dear Mr. Porter:

This letter serves as approval to manufacture sodium N-methyldithiocarbamate (Metam-Na) in the existing Unit 3 at Cedar Chemical Corporation as described in the August 1, 1988, notification. Per your request on August 3, 1988, a copy of the packet submitted is enclosed for your files.

If you have any questions or comments concerning this letter, please contact me at (501) 562-7444 as soon as possible.

Sincerely,

*Lori Ann Scriven*

Lori Ann Scriven  
Engineer  
Air Division

Enclosures



**Spectro-San \*** (Product discontinued by Pfister Chemical, Inc.)

**ACTION:** Disinfectant.

**APPLICATION:** Organotin fungicide for surface disinfection in critical areas of hospitals, public institutions, and schools.

**Speed Sprayer \*** — see Mist Blower.

**Spergon \*** — see Chloranil.

**Sperlox \*** (Product discontinued by Olin Corp.)

**COMPOSITION:** Formulated as a 40% zineb, 50% sulfur, and a combination of sulfur 40% + zineb 8%.

**ACTION:** Foliar fungicide.

**Sperm Oil**

**APPLICATION:** Formulated with various other ingredients as screwworm remedies.

**Spike \*** — see Tebuthiuron.

**Sponto \***

**ACTION:** Series of agricultural emulsifiers.

**APPLICATION:** Used in formulation of emulsifiable pesticide concentrates.

BP: Witco Chemical Corp., Organics Div.

**Spontox \*** — see 2,4,5-T.

**Spore**

The one- to many-celled reproductive unit of a fungus which corresponds to a seed in higher plants; also the thick-walled resting stage of a bacterium.

**Sportak \*** — see Prochloraz.

**Spot Treatment**

A treatment directed at specific plants or areas rather than a general application.

**Spotrete \*** — see Thiram ♦.

**Spotton** — see Baytex \*.

**Spra-Cal \*** — see Calcium Arsenate.

**Spray Ad CVF \***

**CHEMICAL PROPERTIES:** Modified phthalic glycerol alkyd resin.

**ACTION:** Spray adjuvant, spreader-sticker.

**SIGNAL WORD:** WARNING.

**APPLICATION:** Valuable as a spreading, depositing, and sticking agent to improve the performance of insecticides, miticides, fungicides, defoliants, and weed killers. *Spray Ad CVF \** is a water dispersible, resin-based nonionic surfactant. It is *not* a water-soluble detergent-type wetting agent. It resists re-wetting and removal by rain or irrigation.

**FORMULATION:** Liquid.

BP: Rigo Company

**Spray Adjuvant** — see Adjuvant.

**Spray-Aide**

**CHEMICAL NAME:** Alkylaryl polyoxyethylene glycol phosphate ester.

**ACTION:** Compatibility-acidifying agent.

**SIGNAL WORD:** CAUTION.

**HANDLING AND STORAGE CAUTIONS:** Contact may cause eye damage and skin irritation. Harmful if swallowed.

**APPLICATIONS:** *Spray-Aide* is a concentrated compatibility-acidifying agent designed to improve spray tank compatibility of pesticides and to lower pH of spray tank water or liquid fertilizer solutions.

**FORMULATIONS:** *Spray-Aide* is effective for maintaining good compatibility in the spray tank for all agricultural spray products and formulations sprayed in water or in liquid fertilizer solutions.

BP: Miller Chemical & Fertilizer Corp.

**Spray Concentrate**

A liquid formulation of a pesticide usually containing a high percentage of active ingredient which can be diluted with another liquid (water, oil) before using.

**Spray Deposit**

The amount of pesticide chemical that remains on a sprayed surface after the droplets have dried.

**Spray Drift**

The movement of airborne spray particles from the intended area of application. (Weed Science Society of America).

**Sprayer** — see Hand Sprayer, Compressed-Air Sprayer, Knapsack Sprayer, Bucket Pump, Power Sprayer, Mist Blower, Steam Aerosol Fog, Thermal Aerosol Fog.

**Spray Stay \*** — see Sticker.

**Spreader**

Also termed *film extender*. The AAPCO has adopted this definition:

"A substance which increases the area that a given volume of liquid will cover on a solid, or on another liquid."

BP: Aim International Chemicals Corp. (Aim Spreader Activator \*)

BASF Wyandotte Corp. (Citowett \* Plus, Plurafac \* Surfactants, Pluronic \* Polyols)

Buckman Laboratories, Inc. (WSCP, WSCP 2)

Chevron Chemical Co., Ortho Agricultural Chemicals Div. (Ortho X-77 \*)

Crystal Chemical Co. (Ag-Chem Activator \*)

Crystal Chemical Inter-America (Mezclafix, Obex P, Pegafix)

Hopkins Agricultural Chemical Co. (Neptune \*)

ICI Americas Inc., Specialty Chemicals Div. (Atpus \*)

ICI Plant Protection Division (Great Britain) (Agral \* 90)

Kalo Agricultural Chemicals, Inc. (Bio-88 \*, Biofilm \*, Buffer-X \*)

Rigo Company (Spray Ad CVF \*)

Rohm and Haas Co. (Triton \*)

Sellers Chemical Corp. (Flo-Mo \* 200-4)

Vertac Chemical Corp. (Chemcol \*)

Wilbur-Ellis Co., Rhodes Chemical Dept. (R-II Spreader-Activator \*)

Witco Chemical Corp., Organics Div. (Adsee \*)

F: Custom Chemicides Inc. (Aqua-Fix \*, Buffericide \*, Buffer Plus \*, Polyonic \*, Unifilm \*)

Knapp Chemical Co. (K-27, K-90, D-Foam)

PureGro Co. (Leaf Act 80)

**Spreader-Sticker 268** — see Hinder \* Deer and Rabbit Repellent.

**Spring-Bak \*** — see Nabam.

**Spritz-Hormin / 2,4-D** — see 2,4-D.

**Spritz-Hormit 2,4-D** — see 2,4-D.

**s-Propylethyl-N-butyl Thiocarbamate**

**ACTION:** Herbicide.

**APPLICATION:** Preplanting soil application or postemergence soil incorporation on sugar beets and tomatoes.

**Sprout Nip \*** — see Chloro-IPC \*.

**Sprout-Off \*** — see Fair 85.

**Sprout-Stop \*** — see Maleic Hydrazide.

**Sprudamone \*** (Product discontinued by Zoecon Corp.)

**CHEMICAL NAME:** *trans*-11-tetradecenyl aldehyde.

**ACTION:** Attractant (specific for spruce budworm).

**Spud-Nic \*** — see Chloro-IPC \*.

**Squill** — see Red Squill.

**SR 73** — see Bayluscide \*.

**SR - 406** — see Captan ♦.

**SRA 5172** — see Methamidophos ♦.

**SRA 7312** — see Bayrusil \*.

**SRA 7847** — see Hinosan \*.

**SS 1451** — see Eradex \*.

**SS 2074** — see Morestan \*.



Process: CO-300

VOC: Carbon Disulfide	VP=400 @ 20 degree C (68F)
n-Butyl Mercaptan	VP= 83 @ 100 degree F
Allyl Chloride	VP=294 mm @ 68 degree F

Carbon Disulfide. As in the Orfom D-8 production we estimate 0.5 lbs/day loss to the atmosphere. For the last production run the total loss was 6 pounds. On a per cent basis for the total usage this would be 0.02%.

n-Butyl Mercaptan. This raw material was received in a tank truck which was piped direct to the process with no storage tanks used. We estimate the loss to be 0.5 lbs/days for a total loss of 6 pounds, or 0.01% of the total amount consumed in the process.

Allyl Chloride. This raw material was also received in, and used direct from, a tank truck with no storage tank. We estimate the loss to be 0.5 lbs/days for a total loss of 6 pounds. This is 0.01% of the total amount consumed.

Process: Diphone C (Unit 4)

Basis: Manufactured under a toll-conversion contract

Raw Materials

Phenol

Sulfuric Acid (98%)

Sodium Hydroxide

Product

4,4'-Dihydroxydiphenylsulphone (Diphone C)

Process Description

Anhydrous Phenol and 98% Sulfuric Acid are reacted to produce Phenolsulfonic Acid and water. The water is removed under vacuum and the Phenolsulfonic Acid is further reacted with Phenol to produce an isomeric mixture of 4,4- and 2,4-Dihydroxydiphenylsulphone. This is further processed by crystallization, filtration, washing, and drying to give predominately the 4,4-isomer.

Manufacturing Schedule

A contract has been signed to produce Diphone-C for two periods per year; each lasting approximately three months.

Process Considerations

A process wastewater containing Phenolsulfonic Acid and the 2,4-isomer is neutralized in process and shipped to an off-site disposal facility.

The process has no direct air emission, however all process vents pass through SN-04 using water as a scrubber medium. A blower and dust collection filter are used on the drying and bagging operation.

rotary vacuum filters  
dry filters  
drying  
collection to vacuum  
pump



Process: Dinitro-ortho-cresol (DNOC)

Basis: Manufactured under a toll-conversion contract. DNOC is a polymerization inhibitor for styrene.

Raw Materials

Ortho-Cresol  
Nitric Acid  
Calcium Oxide  
Styrene

Products

Dinitro-ortho-cresol in Styrene (various concentration blends)

Process Description

Nitric Acid and raw material are batch charged to a glass-lined reactor system. Successive charges are made maintaining temperature below 200 degrees F. Upon reaction completion, DNOC is blended with Styrene monomer as an inhibitor to polymerization.

An aqueous, acid phase is neutralized in a process vessel and shipped to off-site disposal.

A point source emission (SN-04) contains unreacted oxides of nitrogen, carbon dioxide, and water vapor. Emissions are reduced by utilizing a packed tower scrubbing system utilizing aqueous ammonia as the scrubbing medium.

Process: Methylthiopinacolone Oxime (MTPO)

Basis: MTPO is manufactured under contract for export.

Raw Materials

- Monochloropinacolone (MCP)
- Sodium Hydroxide
- Methyl Mercaptan
- Hydroxylamine Sulfate
- Methyl Alcohol
- Sodium Hypochlorite

Process Description

Monochloropinacolone (MCP) is reacted with the sodium salt of methyl mercaptan to form methylthiopinacolone (MTP). MTP is further reacted to form Methylthiopinacolone Oxime.

Manufacturing Schedule

Production is at the request of the client company and availability of equipment. The product is usually produced for about two months per year and can be manufactured in either Unit 3 or Unit 4.

Process Considerations

Wastewater generated is treated within the confines of the process and then passed to the NPDES permitted, biological treatment system. The wastewater consists of aqueous, process waste and scrubber liquor.

Air emissions consists of methyl mercaptan which is vented at the end of the first reaction step. This sulfur compound is destroyed in a packed tower scrubbing system utilizing sodium hypochlorite. Fugitive emissions consist of methyl mercaptan and methyl alcohol.





Process: Methyl Ethyl Sulfide (MES)

Basis: Manufactured under toll-conversion contract

Raw Materials

Sodium Hydroxide  
Sodium Hypochlorite  
Methyl Mercaptan  
Ethyl Chloride

Product

Methyl Ethyl Sulfide

Process Description

Methyl Ethyl Sulfide is produced by reacting Ethyl Chloride with the sodium salt of Methyl Mercaptan in a aqueous solution. The Methyl Mercaptan is reacted with dilute Sodium Hydroxide to produce the sodium salt and water. When Ethyl Chloride reacts with the sodium salt of Methyl Mercaptan, it produces Methyl Ethyl Sulfide and Sodium chloride. Sodium Chloride dissolves in the aqueous phase while Methyl Ethyl Sulfide is insoluble in water.

Manufacturing Schedule

There is no set schedule for Methyl Ethyl Sulfide production. Current estimates are for four weeks in 1987.

Process Considerations

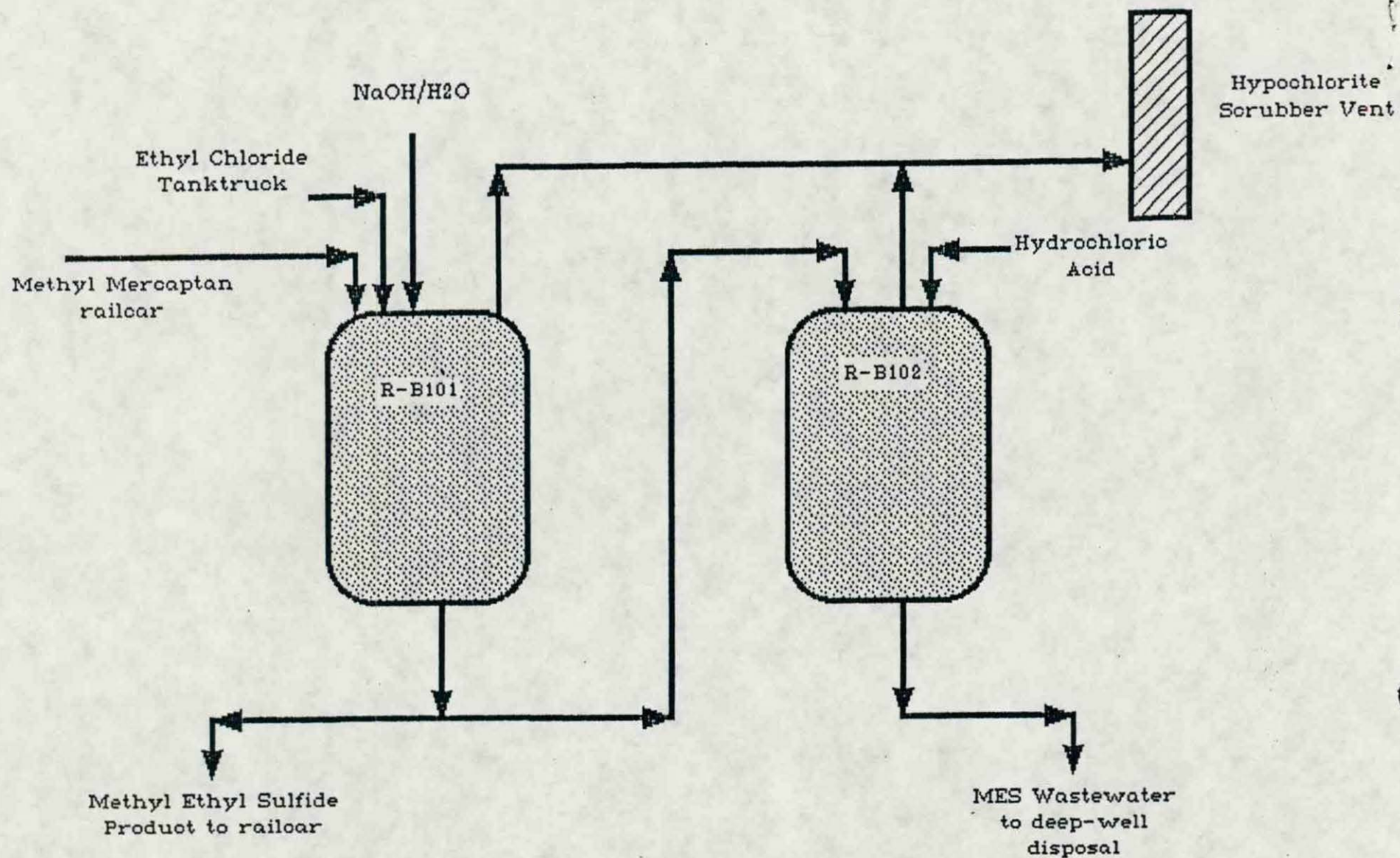
An aqueous waste containing Sodium Chloride and trace amounts of other process chemicals is generated and shipped to an off-site disposal facility. A scrubber system using sodium hypochlorite is used to minimize the loss of odorous process chemicals. No direct emission of pollutants occurs from the process. Fugitive emissions consist of Methyl Mercaptan and Ethyl Chloride. Methyl Mercaptan and Ethyl Chloride are used direct from rail cars and therefore have no on-site storage. The product is placed direct from the process into a rail car for subsequent shipment.



Process: Methyl Ethyl Sulfide

VOC: Methyl Mercaptan	VP=42.5 psia @ 37.8 degree C (100F)
Ethyl Chloride	VP=464 mm @ 32 degree F
Methyl Ethyl Sulfide	VP=280 mm @ 100 degree F

These materials are either used from, or placed into, rail cars.  
There are no on-site storage tanks for these materials.



Cedar Chemical Corporation

Methyl Ethyl Sulfide Process



Process: ORFOM CO300

Basis: Manufactured under a toll conversion contract.

Raw Materials

Sodium Hydroxidide

n-Butyl Mercaptan

Carbon Disulfide

Allyl Chloride

Product

Allyl n-Butyl Trithiocarbonate

Process Description

The salt of n-Butyl Mercaptan is formed and reacted with Carbon Disulfide. The resulting intermediate is reacted with Allyl Chloride.

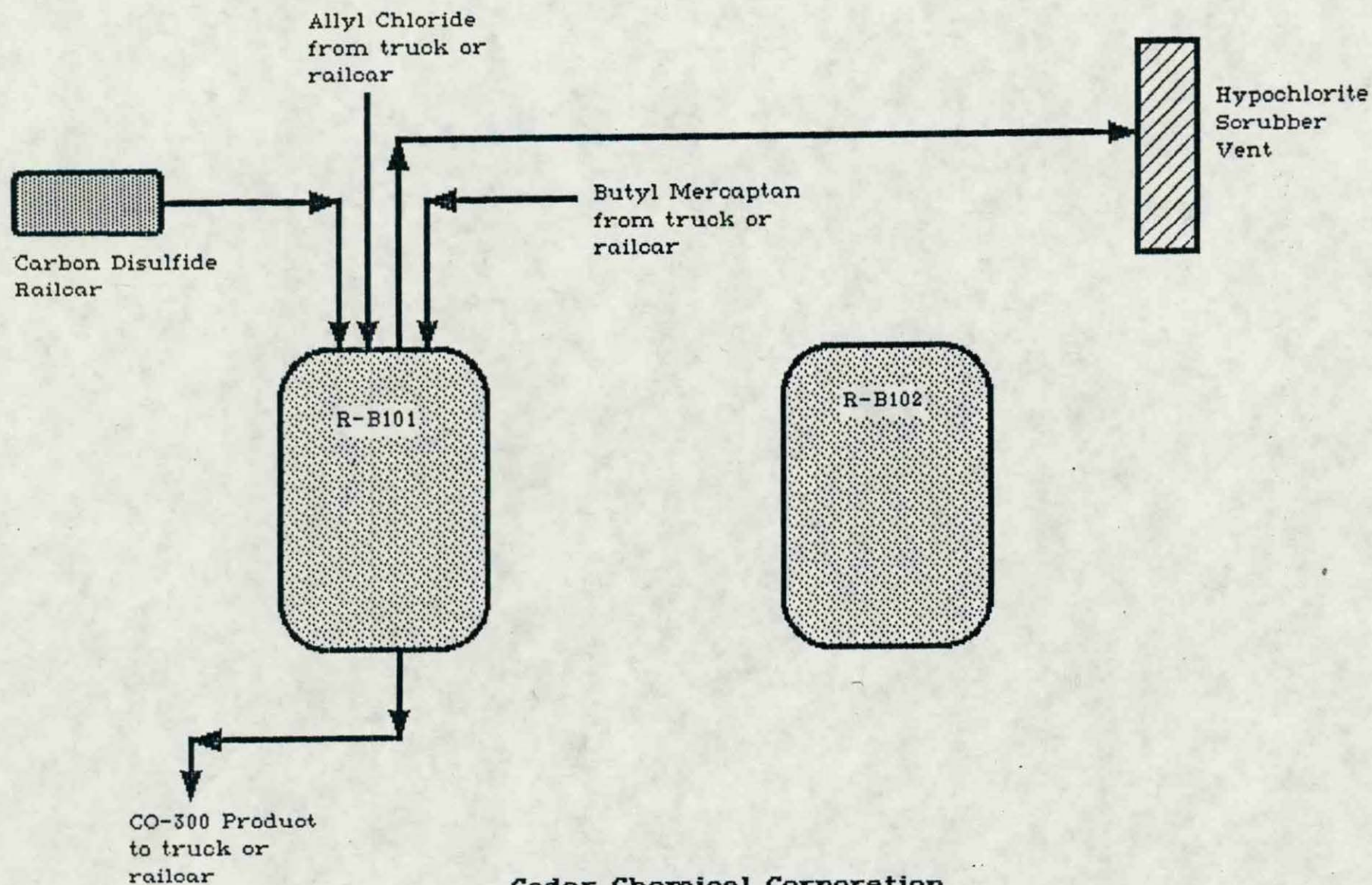
Manufacturing Schedule

ORFOM CO-300 is produced for about four weeks per year, not necessarily contiguous.

Process Considerations

The first reaction step releases water while the final step forms Sodium Chloride. The resulting brine is contaminated with sulfur compounds from process chemicals and is shipped to off-site disposal.

There are no on-site storage tanks and no point source emission of pollutants. Fugitive emissions may consist of n-Butyl Mercaptan, Carbon Disulfide and Allyl Chloride.



Cedar Chemical Corporation

ORFOM CO-300 Process



#### Metam-Sodium

CHEMICAL NAME: Sodium N-methyldithiocarbamate.

COMMON NAMES: metam-sodium; the acid given name metam (BSI, ISO); SMDC, carbam (MAF).

OTHER NAMES: A7 Vapam\*, Busan\* 1020, Karbation\*, Maposol\* (Procida), Metam 32.7, Metam 42, Metam-Fluid BASF\*, Nemasol\*, Solasan\* 500, Sometam\*, Trimaton\*, Vapam\*, VPM\*.

DISCONTINUED NAMES: Sistan\*.

ACTION: Fungicide, herbicide, insecticide, nematocide, soil fumigant.

APPLICATION/USE: Soil fumigant for soil fungi, nematodes, weed soil insects (wireworms, centipedes). Controls weeds and weed seeds. Field area or row application by soil injection or sprinkler injection. Treatment of seed or plant beds, and treatment of potting soil by different methods. Penetration and effectiveness is improved somewhat by a water seal although this is not necessary.

SIGNAL WORD: CAUTION. Metam-Fluid\*: WARNING.

TOXICITY CLASS: III: II (Metam-Fluid\*).

TOXICITY: Formulated: Acute oral LD<sub>50</sub> (male rat), 1700-1800 mg/kg.

ANTIDOTE: None. Treat symptomatically.

CHEMICAL PROPERTIES: White crystalline solid.

SOLUBILITY: Solubility in water 722 g/l at 20°C. Moderately soluble in ethanol. Insoluble in most organic solvents.

HANDLING AND STORAGE CAUTIONS: Stable in concentrated solution but unstable on dilution. Avoid contact with skin and eyes. May be fatal if swallowed, inhaled or absorbed through skin. Material

#### Metam-Sodium (Cont.)

must be handled in open (e.g. outdoors), and inhalation must be prevented.

PROTECTIVE CLOTHING: Nemasol\*: Clothing and equipment consistent with good pesticide handling.

FORMULATIONS: 380-560 g/l soluble concentrates. Aqueous solutions: 32.7%, 33%, 40%, 42%, 50%.

BP: BASF AG (F.R.G.) (Metam-Fluid BASF\*, Nemasol\*)  
Buckman Laboratories, Inc. (Busan\* 1020)  
Energia E Industrias Aragonesas, S.A. (Spain) (Arapam\*)  
Pennwalt Holland B.V. (Netherlands) (Trimaton\*)  
Rhône-Poulenc Agrochimie (France) (Solasan 500\*)  
ICI Americas, Inc.<sup>1</sup> (Vapam\*)  
United Agri Products, Inc. (Nemasol\*)  
Universal Crop Protection Ltd. (U.K.)  
UCB Chem. Corp. (Metam 32.7%, 42%)  
Visplant Chimiren S.r.l.<sup>1</sup> (Italy) (Sometam\*)



**GRACE**

Organic Chemicals Division  
W.R. Grace & Co.  
55 Hayden Avenue  
Lexington, Mass. 02173

# MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 713 - 479 - 7348

## SECTION ONE - PRODUCT DESCRIPTION

IDENTITY: Nitromethane

MSDS DATE: 05-13-87

SYNONYMS: Nitrocarbinol, NM

CHEMICAL FORMULA:  $\text{CH}_3\text{NO}_2$

CAS Number: 75-52-5

TSCA LISTING: This product is listed in the TSCA inventory.

## SECTION TWO - HAZARDOUS INGREDIENTS

CHEMICAL NAME [CAS NUMBER]	PERCENT PRESENT	TLV*	PEL
Nitromethane [75-52-5]	>95	100 ppm TWA	100 ppm TWA
Nitroethane [79-24-3]	<3	100 ppm TWA	100 ppm TWA
1-Nitropropane [108-03-2]	<0.5	25 ppm TWA	25 ppm TWA
2-Nitropropane [79-46-9]	<1	10 ppm TWA	25 ppm TWA

\*Also Grace Internal Limit unless otherwise specified

N.A. = Not applicable

N.E. = None established

NAIF = No applicable information found

TLV = Threshold Limit Value  
(ACGIH guideline)

PEL = Permissible Exposure Limit  
(OSHA legal limit)

TWA = Time Weighted Average  
for 8 hrs unless otherwise specified

C = Ceiling value

LEL = Lower Explosive Limit

UEL = Upper Explosive Limit

## SECTION THREE - PHYSICAL DATA

APPEARANCE AND ODOR: Colorless liquid with mild, fruity odor.

BOILING POINT: 214°F/101°C

SPECIFIC GRAVITY: 1.139 (Water = 1)

FREEZING POINT: -20°F/-29°C

% VOLATILE BY WT.: 100

VAPOR PRESSURE: 27.8 mm Hg @ 20°C

EVAPORATION RATE: 1.8 (BuAc = 1)

VAPOR DENSITY: 2.1 (Air = 1)

WATER SOLUBILITY: 9.5% wt @ 20°C

The information contained herein is based upon data considered true and accurate. However, Grace makes no warranties, express or implied, as to the accuracy or adequacy of the information contained herein or the results to be obtained from the use thereof. This information is offered solely for the user's consideration, investigation and verification. Since the use and conditions of use of this information and the material described herein are not within the control of Grace, Grace assumes no responsibility for injury to the user or third persons. The material described herein is sold only pursuant to Grace's Terms and Conditions of Sale, including those limiting warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of this data and information is in accordance with applicable federal, state or local laws and regulations.



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**SECTION FOUR - FIRE FIGHTING DATA**

NFPA Ratings (applicable to fire fighting situations only): Health -1, Flammability-3,  
Reactivity-3

FLASH POINT: 95°F/35°C

METHOD: Closed Cup

FLAMMABLE LIMIT - LEL: 7.3%

UEL: Unknown

APPROXIMATE IGNITION TEMPERATURE: 785°F/418°C

EXTINGUISHING MEDIA: Water, foam, carbon dioxide, and Halon system. Use only the Triclass type dry chemical extinguishers for classes A, B, & C. Use of other dry chemical extinguishers will cause re-ignition of the fire.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self-contained breathing apparatus. Fight fires from an explosion-resistant location. Cool drums and tanks with water spray and continue to cool after fire has been extinguished. Stay upwind and out of low areas. If tank or truck is involved in a fire, isolate for  $\frac{1}{2}$  mile in all directions.

UNUSUAL FIRE & EXPLOSION HAZARDS: Flammable liquid. Combustion products may contain nitrogen oxides or carbon oxides. Vapor is heavier than air and may travel a considerable distance to ignition source and flashback. Decomposes explosively at critical temperature of 599°F and critical pressure of 915 psig.

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**SECTION FIVE - HEALTH & FIRST AID DATA**

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH: 1000 ppm.

PRIMARY ROUTES OF EXPOSURE: Inhalation of mist or vapor. Eye and skin contact.

WARNING PROPERTIES: Strong >100 ppm and irritating at 200 ppm. Not considered to have good warning properties.

HEALTH HAZARDS (ACUTE AND CHRONIC): Oral LD<sub>50</sub> for rats is 1210 mg/kg. Irritating to eyes. Repeated exposure has caused mild skin irritation due to defatting effects. Animal studies produced respiratory tract irritation with breathing difficulties that may be delayed in onset. Weak narcotic. Chronic exposure of animals indicates some liver and kidney injury. No effects attributable to NM have been reported in humans.

CARCINOGENICITY: Based on animal studies 2-nitropropane, a component, has been listed by IARC and NTP as a suspect carcinogen but is not listed by OSHA. Other components are not listed by NTP, IARC, or OSHA as suspect or proven carcinogens.

SIGNS & SYMPTOMS OF OVEREXPOSURE: Weakness, incoordination, dizziness, narcosis, convulsions. Burning, soreness in nose, throat, or lungs.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Persons with pre-existing lung conditions may be more susceptible to irritation effects. Persons with impaired liver function may be more susceptible to effects caused by liver damage.

**EMERGENCY AND FIRST AID PROCEDURES:**

Eye Contact: Immediately flush with large quantities of water for at least 15 minutes while holding the eyelids open. Contact a physician immediately.

Skin Contact: Immediately remove contaminated clothing and flush area with large quantities of water for at least 15 minutes. Contact a physician if irritation develops.



Ingestion: Induce vomiting if patient is conscious. Do not induce vomiting in an unconscious patient. Contact a physician immediately.

Inhalation: Remove from contaminated atmosphere. If breathing has stopped, give artificial respiration then oxygen if needed. Contact a physician immediately. Effects of inhalation overexposure may not be immediately obvious.

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#### SECTION SIX - REACTIVITY DATA

STABILITY: Stable at normal temperatures and pressures. Unstable at elevated temperatures and pressure.

CONDITIONS TO AVOID: Decomposes explosively at critical temperature of 599°F and critical pressure of 915 psig. Can be detonated by shock from high explosives, or by heat if under strong confinement. Mixing with amines, acids, or certain other chemical compounds will cause NM to become more sensitive to detonation.

INCOMPATIBILITY WITH OTHER MATERIALS: Amines, strong acids, alkalies (lye, caustic), strong oxidizers, metal oxides, hydrocarbons, and other combustible materials. Lead, copper, and their alloys.

HAZARDOUS DECOMPOSITION PRODUCTS: Nitrogen oxides, carbon oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID UNCONTROLLED POLYMERIZATION: N.A.

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#### SECTION SEVEN - SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN TO HANDLE SPILLS OR RELEASES: Evacuate area of nonessential personnel. Ventilate area. Eliminate ignition sources. No flames, sparks or flares allowed in spill area. Vapor may collect in low areas or travel a considerable distance to ignition source and flash back. Prevent from entering drinking water supplies or streams. Collect with non-combustible absorbent material and package for disposal according to local, state, and federal regulations.

WASTE DISPOSAL PROCEDURES: When disposing of pure product as a waste according to EPA regulation 40 CFR 261 classify and label as follows:

DOT Name and Number = Waste Nitromethane, UN1261  
EPA Name and Number = Ignitable, D001

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#### SECTION EIGHT - SPECIAL PROTECTION INFORMATION

VENTILATION: If necessary, appropriate explosion-proof exhaust ventilation for the handling conditions is recommended. Dilution ventilation is not recommended as the sole control mechanism.

PROTECTIVE EQUIPMENT: Minimum - chemical safety goggles with side shields and impervious gloves. Do not wear contact lenses when handling chemicals. Wear impervious clothing if possibility of body contact exists.



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RESPIRATORY PROTECTION: Use pressure-type full-face supplied air or self-contained breathing apparatus. Do not use cartridge-type respirators.

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## SECTION NINE - SPECIAL PRECAUTIONS

WORK/HYGIENIC PRACTICES: Before entering a confined space, check for vapor accumulation. Wash thoroughly after handling. Wash contaminated clothes before re-use. Launder work clothes separately from family clothes. Check protective clothing, especially impervious gloves, for leaks before use. Transfer equipment must be grounded. Do not use lye or caustic to clean drums or equipment that has contacted NM. Dry salts of inorganic bases and NM are explosive.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Store in cool, dry, and well ventilated area. Keep containers closed to maintain nitrogen blanket. Use only DOT-approved containers. Do not enter storage area unless area is adequately ventilated. Protect against physical damage. Nitromethane should be stored in a suitably isolated outdoor storage facility. Because of the explosion potential presented, every possible means should be taken to protect the storage area from exposure to external fires. Explosives and hazardous processing should not be permitted in the vicinity of the storage areas. Separate from oxidizing materials. Dry product may be stored in steel. Wet product (>0.2% water) must be stored in stainless steel or aluminum.

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## SECTION TEN - REGULATORY COMMENTS

Nitromethane is not a hazardous substance (40 CFR 116), toxic pollutant (40 CFR 129), or "priority pollutant" pursuant to the Federal Water Pollution Control Act, sections 311 (b)(2)(A), 307 (a).

Nitromethane is not a hazardous air pollutant (40 CFR 61) pursuant to the Clean Air Act, section 112.

Nitromethane is minimally photochemically reactive and, therefore, is classified as a solvent exempt from volume restrictions under Rule 66 of the Air Pollution Control District of Los Angeles County, Regulation 3 of the Bay Area Air Pollution Control District, or other similar pollution legislation in the United States.



**GRACE**

Organic Chemicals Division  
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# MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 603 - 888 - 2320

Page: 1 of 3

**SECTION ONE - PRODUCT DESCRIPTION**

IDENTITY: **AMP-95**  
EXPERIMENTAL PRODUCT

MSDS DATE: 09-01-87

CHEMICAL DESCRIPTION: 1-Propanol, 2-amino-2-methyl-  
SYNONYMS: Isobutanol-2-amine

CAS Number: 124-68-5  
TSCA LISTING: This product is listed in the TSCA inventory.

**SECTION TWO - HAZARDOUS INGREDIENTS**

CHEMICAL NAME [CAS NUMBER]	PERCENT PRESENT	TLV*	PEL
AMP-95 [124-68-5]	~95	N.E.	N.E.

\*Also Grace Internal Limit unless otherwise specified

N.A. = Not applicable

NAIF = No applicable information found

TLV = Threshold Limit Value  
(ACGIH guideline)TWA = Time Weighted Average  
for 8 hrs unless otherwise specified

LEL = Lower Explosive Limit

N.E. = None established

N.D. = Not determined

PEL = Permissible Exposure Limit  
(OSHA legal limit)

C = Ceiling value

UEL = Upper Explosive Limit

**SECTION THREE - PHYSICAL DATA**

APPEARANCE AND ODOR: Colorless liquid with a faint, fishy odor.

BOILING POINT: ~ same as water

MELTING POINT: N.A.

VAPOR PRESSURE: ~ same as water

VAPOR DENSITY: ~ same as water

WATER SOLUBILITY: Completely miscible

SPECIFIC GRAVITY: 0.94

% VOLATILE BY WT.: 5% as water

EVAPORATION RATE: ~ same as water

pH of 1% Solution: 13.0

**SECTION FOUR - FIRE FIGHTING DATA**

FLASH POINT: &gt;200°F -aqueous

FLAMMABLE LIMIT - LEL: N.D.

METHOD: N.D.

UEL: N.D.

The information contained herein is based upon data considered true and accurate. However, Grace makes no warranties, express or implied, as to the accuracy or adequacy of the information contained herein or the results to be obtained from the use thereof. This information is offered solely for the user's consideration, investigation and verification. Since the use and conditions of use of this information and the material described herein are not within the control of Grace, Grace assumes no responsibility for injury to the user or third persons. The material described herein is sold only pursuant to Grace's Terms and Conditions of Sale, including those limiting warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of this data and information is in accordance with applicable federal, state or local laws and regulations.



EXTINGUISHING MEDIA: Water, dry chemical, carbon dioxide, foam.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self contained breathing apparatus with full face-piece. Use water spray to cool fire-exposed containers.

UNUSUAL FIRE & EXPLOSION HAZARDS: None.

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#### SECTION FIVE - HEALTH & FIRST AID DATA

PRIMARY ROUTES OF EXPOSURE: Eye and skin contact. Inhalation exposure is not likely unless material is heated.

HEALTH HAZARDS (ACUTE AND CHRONIC): Oral LD<sub>50</sub> for rats is 2300 mg/kg expected to be slightly toxic by ingestion. Due to pH may be irritating to eyes and skin. Inhalation of heated vapor or a mist may be irritating to the respiratory tract.

CARCINOGENICITY: This material is not listed by NTP, IARC, or OSHA as a suspect or proven carcinogen. There is no evidence that indicates the material may be carcinogenic to humans or animals.

SIGNS & SYMPTOMS OF OVEREXPOSURE: Redness, burning, tearing of eyes. Red, swollen, or inflamed skin. Coughing, wheezing, chest tightness.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Persons with pre-existing skin or lung disorders may be more susceptible to the irritating properties of the material.

#### EMERGENCY AND FIRST AID PROCEDURES:

Eye Contact: Immediately flush with large quantities of water for at least 15 minutes while holding the eyelids open. Do not attempt to neutralize with chemical agents. Contact a physician immediately.

Skin Contact: Immediately remove contaminated clothing and flush area with large quantities of water for at least 15 minutes. Do not attempt to neutralize with chemical agents. Contact a physician immediately.

Ingestion: If conscious, give large quantities of water to drink. Do not induce vomiting. Do not give an unconscious person anything by mouth. Contact a physician immediately.

Inhalation: Remove from contaminated atmosphere. If breathing has stopped, give artificial respiration then oxygen if needed. Contact a physician immediately.

---

#### SECTION SIX - REACTIVITY DATA

STABILITY: Stable.

CONDITIONS TO AVOID: N.A.

INCOMPATIBILITY WITH OTHER MATERIALS: Oxidizing materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, carbon dioxide, nitrogen oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID UNCONTROLLED POLYMERIZATION: N.A.

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**SECTION SEVEN - SPILL & DISPOSAL PROCEDURES**

**STEPS TO BE TAKEN TO HANDLE SPILLS OR RELEASES:** Evacuate area of nonessential personnel. Ventilate area. Prevent from entering drinking water supplies or streams. Collect with absorbent material and package for disposal according to local, state, and federal regulations.

**WASTE DISPOSAL PROCEDURES:** Check the as is pH. If above 12.5 classify and label as follows:

EPA Name: Corrosive.....No. = D002

---

**SECTION EIGHT - SPECIAL PROTECTION INFORMATION**

**VENTILATION:** If necessary, appropriate exhaust ventilation for the handling conditions is recommended. Dilution ventilation is not recommended as the sole control mechanism.

**PROTECTIVE EQUIPMENT:** Minimum - chemical safety goggles with side shields and impervious gloves. Do not wear contact lenses when handling chemicals. Wear impervious clothing if possibility of body contact exists.

**RESPIRATORY PROTECTION:** Use an approved organic vapor respirator within use limitations. In all other situations use self-contained breathing apparatus.

---

**SECTION NINE - SPECIAL PRECAUTIONS**

**WORK/HYGIENIC PRACTICES:** Wash thoroughly after handling. Wash contaminated clothes before re-use. Launder work clothes separately from family clothes. Check protective clothing, especially impervious gloves, for leaks before use.

**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:** Do not store near oxidizing materials. Store in cool, dry, and well ventilated area. Keep containers closed. Use only DOT-approved containers. Do not enter storage area unless area is adequately ventilated.



Process: Permethrin, Technical (Unit 1)

Basis: Manufactured under contract for ICI Americas. Permethrin is one of a group of synthetic, pyrethroid insecticides. They are used in a wide variety of applications for insect control.

Raw Materials

- Permethrin Acid, Methyl Ester (PAM)
- Sodium Hydroxide
- Methyl Alcohol
- Hydrochloric Acid
- Sodium Chloride
- Toluene
- Catalyst
- Thionyl Chloride
- Phenoxy Benzyl Alcohol (PBA)

Products

- Permethrin Acid Chloride
- Permethrin, Technical

Process Description

The methyl ester of permethrin acid is hydrolyzed to the free acid. Under catalytic conditions, the acid chloride is formed. The acid chloride is then re-esterified with an alcohol to form the technical product.

Manufacturing Schedule

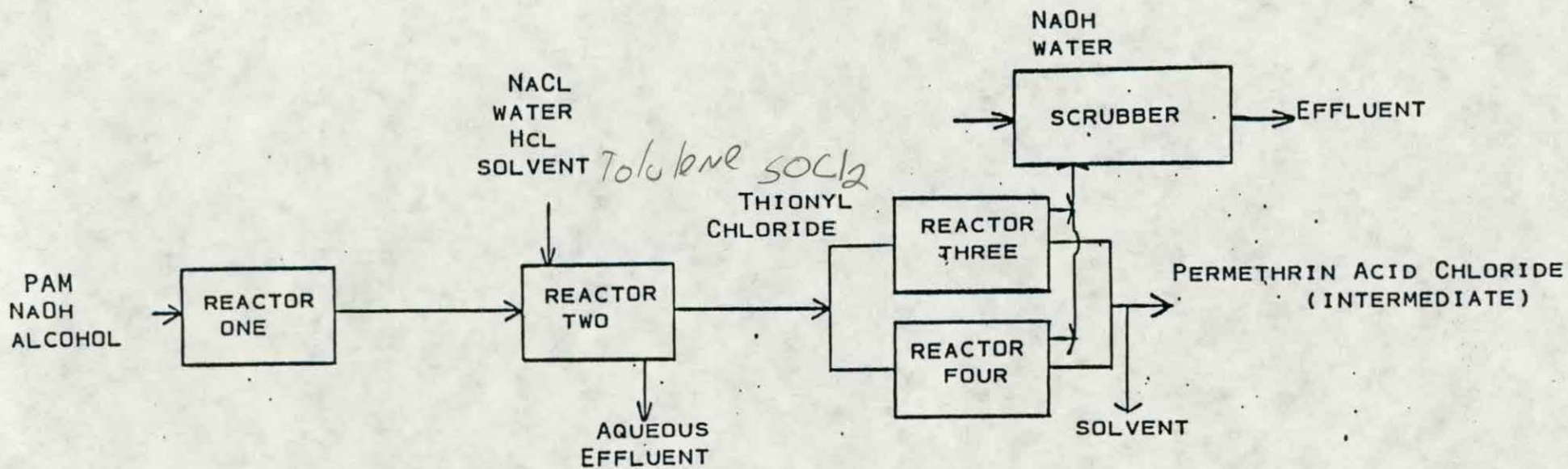
Production is solely at the discretion of the client company and is coordinated with a second product, Cypermethrin. Permethrin and Permethrin Acid Chloride represent approximately twenty-five per cent of the total pounds produced annually. Total manufacturing time for all products is nine to ten months per year: December through September.

Process Considerations

Wastewater generated in this process consists of aqueous hydrolysis waste, brine washes, unrecovered solvent, and spent scrubber liquor. All wastewater is shipped off-site to deep-well disposal.

The Acid Chloride formation releases sulfur dioxide and hydrochloric acid. The final hydrolysis step releases hydrochloric acid. Both of these emissions are controlled by a packed tower scrubbing system utilizing sodium hydroxide. The point source emission consists of sulfur dioxide, hydrochloric acid, and toluene. Fugitive emissions consist of methyl alcohol and Toluene.

VERTAC CHEMICAL CORPORATION  
WEST HELENA, ARKANSAS  
JANUARY 10, 1983



PROCESS: PERMETHRIN ACID CHLORIDE (INTERMEDIATE)

MANUFACTURED FOR: ICI AMERICAS, INC.



**GRACE**

Organic Chemicals Division  
W.R. Grace & Co.  
55 Hayden Avenue  
Lexington, Mass. 02173

# MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 603-888-2320

Page: 1 of 3

**SECTION ONE - PRODUCT DESCRIPTION**

IDENTITY: **2-AB**  
EXPERIMENTAL PRODUCT

MSDS DATE: 09-01-87

CHEMICAL DESCRIPTION: **2-Amino-1-butanol**SYNONYMS: 2-Aminobutan-1-ol; butanol-2-amine; D,L-2-amino-1-butanol; ( $\pm$ )2-amino-1-butanol

CAS Number: 96-20-8

TSCA LISTING: This product is listed in the TSCA inventory.

**SECTION TWO - HAZARDOUS INGREDIENTS**

CHEMICAL NAME [CAS NUMBER]	PERCENT PRESENT	TLV*	PEL
2-Amino-1-butanol [96-20-8]	~100	N.E.	N.E.

\*Also Grace Internal Limit unless otherwise specified

N.A. = Not applicable

NAIF = No applicable information found

TLV = Threshold Limit Value  
(ACGIH guideline)TWA = Time Weighted Average  
for 8 hrs unless otherwise specified

LEL = Lower Explosive Limit

N.E. = None established

N.D. = Not determined

PEL = Permissible Exposure Limit  
(OSHA legal limit)

C = Ceiling value

UEL = Upper Explosive Limit

**SECTION THREE - PHYSICAL DATA**

APPEARANCE AND ODOR: Pale yellow liquid with a faint, fishy odor.

BOILING POINT: 352°F/178 C

MELTING POINT: N.A.

VAPOR PRESSURE: 7.5 mm Hg @ 25 C

VAPOR DENSITY: ~3.06

WATER SOLUBILITY: Completely miscible.

SPECIFIC GRAVITY: 0.94

% VOLATILE BY WT.: N.A.

EVAPORATION RATE: N.D.

pH of 1% Solution: 11.1

**SECTION FOUR - FIRE FIGHTING DATA**

FLASH POINT: 193°F (89 C)

FLAMMABLE LIMIT - LEL: N.D.

METHOD: Closed Cup

UEL: N.D.

The information contained herein is based upon data considered true and accurate. However, Grace makes no warranties, express or implied, as to the accuracy or adequacy of the information contained herein or the results to be obtained from the use thereof. This information is offered solely for the user's consideration, investigation and verification. Since the use and conditions of use of this information and the material described herein are not within the control of Grace, Grace assumes no responsibility for injury to the user or third persons. The material described herein is sold only pursuant to Grace's Terms and Conditions of Sale, including those limiting warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of this data and information is in accordance with applicable federal, state or local laws and regulations.



EXTINGUISHING MEDIA: Water, dry chemical, carbon dioxide, foam.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self contained breathing apparatus with full face-piece. Use water spray to cool fire-exposed containers.

UNUSUAL FIRE & EXPLOSION HAZARDS: Combustible liquid.

---

## SECTION FIVE - HEALTH & FIRST AID DATA

PRIMARY ROUTES OF EXPOSURE: Eye and skin contact. Inhalation exposure is not likely unless material is heated or a mist is generated.

HEALTH HAZARDS (ACUTE AND CHRONIC): Oral LD<sub>50</sub> for mice is 2300 mg/kg - slightly toxic by ingestion. Due to pH may be irritating to eyes and skin. Inhalation of heated vapor or a mist may be irritating to the respiratory tract.

CARCINOGENICITY: This material is not listed by NTP, IARC, or OSHA as a suspect or proven carcinogen. There is no evidence that indicates the material may be carcinogenic to humans or animals.

SIGNS & SYMPTOMS OF OVEREXPOSURE: Redness, burning, tearing of eyes. Red, swollen, or inflamed skin. Coughing, wheezing, chest tightness.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Persons with pre-existing skin or lung disorders may be more susceptible to the irritating properties of the material.

### EMERGENCY AND FIRST AID PROCEDURES:

Eye Contact: Immediately flush with large quantities of water for at least 15 minutes while holding the eyelids open. Do not attempt to neutralize with chemical agents. Contact a physician immediately.

Skin Contact: Immediately remove contaminated clothing and flush area with large quantities of water for at least 15 minutes. Do not attempt to neutralize with chemical agents. Contact a physician immediately.

Ingestion: If conscious, give large quantities of water to drink. Do not induce vomiting. Do not give an unconscious person anything by mouth. Contact a physician immediately.

Inhalation: Remove from contaminated atmosphere. If breathing has stopped, give artificial respiration then oxygen if needed. Contact a physician immediately.

---

## SECTION SIX - REACTIVITY DATA

STABILITY: Stable.

CONDITIONS TO AVOID: N.A.

INCOMPATIBILITY WITH OTHER MATERIALS: Oxidizing materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, carbon dioxide, nitrogen oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID UNCONTROLLED POLYMERIZATION: N.A.



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**SECTION SEVEN - SPILL & DISPOSAL PROCEDURES**

STEPS TO BE TAKEN TO HANDLE SPILLS OR RELEASES: Evacuate area of nonessential personnel. Ventilate area. Prevent from entering drinking water supplies or streams. Collect with absorbent material and package for disposal according to local, state, and federal regulations.

WASTE DISPOSAL PROCEDURES: Check the as is pH. If above 12.5 classify and label as follows:

EPA Name: Corrosive.....No. = D002

---

**SECTION EIGHT - SPECIAL PROTECTION INFORMATION**

VENTILATION: If necessary, appropriate exhaust ventilation for the handling conditions is recommended. Dilution ventilation is not recommended as the sole control mechanism.

PROTECTIVE EQUIPMENT: Minimum - chemical safety goggles with side shields and impervious gloves. Do not wear contact lenses when handling chemicals. Wear impervious clothing if possibility of body contact exists.

RESPIRATORY PROTECTION: Use an approved organic vapor respirator within use limitations. In all other situations use self-contained breathing apparatus.

---

**SECTION NINE - SPECIAL PRECAUTIONS**

WORK/HYGIENIC PRACTICES: Wash thoroughly after handling. Wash contaminated clothes before re-use. Launder work clothes separately from family clothes. Check protective clothing, especially impervious gloves, for leaks before use.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Do not store near oxidizing materials. Store in cool, dry, and well ventilated area. Keep containers closed. Use only DOT-approved containers. Do not enter storage area unless area is adequately ventilated.

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Organic Chemicals Division  
W.R. Grace & Co.  
55 Hayden Avenue  
Lexington, Mass. 02173

# MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 603 - 888 - 2320

Page: 1 of 3

**SECTION ONE - PRODUCT DESCRIPTION**

IDENTITY: **TA-100**   
EXPERIMENTAL PRODUCT

MSDS DATE: 09-01-87

CHEMICAL DESCRIPTION: **1,3-Propanediol; 2-amino-2-(hydroxymethyl)**  
SYNONYMS: Tris(hydroxymethyl)aminomethane; TRIS buffer; THAM; Tromethane; Talatrol

CAS Number: **77-86-1** 

TSCA LISTING: This product is listed in the TSCA inventory.

**SECTION TWO - HAZARDOUS INGREDIENTS**

CHEMICAL NAME [CAS NUMBER]	PERCENT PRESENT	TLV*	PEL
TA-100 [77-86-1]	~100	N.E.	N.E.

\*Also Grace Internal Limit unless otherwise specified

N.A. = Not applicable

NAIF = No applicable information found

TLV = Threshold Limit Value  
(ACGIH guideline)TWA = Time Weighted Average  
for 8 hrs unless otherwise specified

LEL = Lower Explosive Limit

N.E. = None established


N.D. = Not determined

PEL = Permissible Exposure Limit  
(OSHA legal limit)


C = Ceiling value

UEL = Upper Explosive Limit

**SECTION THREE - PHYSICAL DATA**

APPEARANCE AND ODOR: White crystalline solid with a faint, fishy odor.  
BOILING POINT: N.A. BULK DENSITY: 52 lb/ft<sup>3</sup>  
MELTING POINT: 340°F (171 C) % VOLATILE BY WT.: N.A.  
VAPOR PRESSURE: N.A. EVAPORATION RATE: N.A.  
VAPOR DENSITY: N.A. pH of 1% Solution: 10.4   
WATER SOLUBILITY: 70g/100g at 25 C

**SECTION FOUR - FIRE FIGHTING DATA**

FLASH POINT: N.A.  METHOD: N.A.  
FLAMMABLE LIMIT - LEL: N.A. UEL: N.A.

The information contained herein is based upon data considered true and accurate. However, Grace makes no warranties, express or implied, as to the accuracy or adequacy of the information contained herein or the results to be obtained from the use thereof. This information is offered solely for the user's consideration, investigation and verification. Since the use and conditions of use of this information and the material described herein are not within the control of Grace, Grace assumes no responsibility for injury to the user or third persons. The material described herein is sold only pursuant to Grace's Terms and Conditions of Sale, including those limiting warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of this data and information is in accordance with applicable federal, state or local laws and regulations.



EXTINGUISHING MEDIA: Water, dry chemical, carbon dioxide, foam.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self contained breathing apparatus with full face-piece. Use water spray to cool fire-exposed containers.

UNUSUAL FIRE & EXPLOSION HAZARDS: Severe dusting may generate an explosion hazard.

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## SECTION FIVE - HEALTH & FIRST AID DATA

PRIMARY ROUTES OF EXPOSURE: Eye and skin contact. Inhalation exposure is not likely unless handling condition generates a dust.

HEALTH HAZARDS (ACUTE AND CHRONIC): Oral LD<sub>50</sub> for rabbits is 1000 mg/kg. Expected to be slightly toxic by ingestion. Due to pH may be irritating to eyes and skin. Inhalation of dust may be irritating to the respiratory tract.

CARCINOGENICITY: This material is not listed by NTP, IARC, or OSHA as a suspect or proven carcinogen. There is no evidence that indicates the material may be carcinogenic to humans or animals.

SIGNS & SYMPTOMS OF OVEREXPOSURE: Redness, burning, tearing of eyes, Red, swollen, or inflamed skin. Coughing, wheezing, chest tightness.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Persons with pre-existing skin or lung disorders may be more susceptible to the irritating properties of the material.

### EMERGENCY AND FIRST AID PROCEDURES:

Eye Contact: Immediately flush with large quantities of water for at least 15 minutes while holding the eyelids open. Do not attempt to neutralize with chemical agents. Contact a physician immediately.

Skin Contact: Immediately remove contaminated clothing and flush area with large quantities of water for at least 15 minutes. Do not attempt to neutralize with chemical agents. Contact a physician immediately.

Ingestion: If conscious, give large quantities of water to drink. Do not induce vomiting. Do not give an unconscious person anything by mouth. Contact a physician immediately.

Inhalation: Remove from contaminated atmosphere. If breathing has stopped, give artificial respiration then oxygen if needed. Contact a physician immediately.

---

## SECTION SIX - REACTIVITY DATA

STABILITY: Stable.

CONDITIONS TO AVOID: N.A.

INCOMPATIBILITY WITH OTHER MATERIALS: Oxidizing materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, carbon dioxide, nitrogen oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID UNCONTROLLED POLYMERIZATION: N.A.

---

**SECTION SEVEN - SPILL & DISPOSAL PROCEDURES**

**STEPS TO BE TAKEN TO HANDLE SPILLS OR RELEASES:** Evacuate area of nonessential personnel. Ventilate area. Prevent from entering drinking water supplies or streams. Collect and package for disposal according to local, state, and federal regulations.

**WASTE DISPOSAL PROCEDURES:** Check the as is pH. If above 12.5 classify and label as follows:

EPA Name: Corrosive.....No. = D002

---

**SECTION EIGHT - SPECIAL PROTECTION INFORMATION**

**VENTILATION:** If necessary, appropriate exhaust ventilation for the handling conditions is recommended. Dilution ventilation is not recommended as the sole control mechanism.

**PROTECTIVE EQUIPMENT:** Minimum - chemical safety goggles with side shields and impervious gloves. Do not wear contact lenses when handling chemicals. Wear impervious clothing if possibility of body contact exists.

**RESPIRATORY PROTECTION:** Use a toxic dust respirator within use limitations. In all other situations use self-contained breathing apparatus.

---

**SECTION NINE - SPECIAL PRECAUTIONS**

**WORK/HYGIENIC PRACTICES:** Wash thoroughly after handling. Wash contaminated clothes before re-use. Launder work clothes separately from family clothes. Check protective clothing, especially impervious gloves, for leaks before use.

**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:** Do not store near oxidizing materials. Store in cool, dry, and well ventilated area. Keep containers closed. Use only DOT-approved containers. Do not enter storage area unless area is adequately ventilated.



**GRACE**

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55 Hayden Avenue  
Lexington, Mass. 02173

# MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 713 - 479 - 7348

## SECTION ONE - PRODUCT DESCRIPTION

IDENTITY: 2-Nitropropane

MSDS DATE: 05-13-87

SYNONYMS: 2-NP, Nitropropane

CHEMICAL FORMULA:  $\text{CH}_3\text{CH}(\text{NO}_2)\text{CH}_3$

CAS Number: 79-46-9

TSCA LISTING: This product is listed in the TSCA inventory.

## SECTION TWO - HAZARDOUS INGREDIENTS

CHEMICAL NAME [CAS NUMBER]	PERCENT PRESENT	TLV*	PEL
2-Nitropropane [79-46-9]	>94	10 ppm TWA	25 ppm TWA
Nitromethane [75-52-5]	<1	100 ppm TWA	100 ppm TWA
Nitroethane [79-24-3]	<3	100 ppm TWA	100 ppm TWA
1-Nitropropane [108-03-2]	<3	25 ppm TWA	25 ppm TWA

\*Also Grace Internal Limit unless otherwise specified

N.A. = Not applicable

N.E. = None established

NAIF = No applicable information found

TLV = Threshold Limit Value

PEL = Permissible Exposure Limit

(ACGIH guideline)

(OSHA legal limit)

TWA = Time Weighted Average

C = Ceiling value

for 8 hrs unless otherwise specified

LEL = Lower Explosive Limit

UEL = Upper Explosive Limit

## SECTION THREE - PHYSICAL DATA

APPEARANCE AND ODOR: Colorless liquid with mild, fruity odor.

BOILING POINT: 248°F/120°C

SPECIFIC GRAVITY: 0.99 (Water = 1)

FREEZING POINT: -132°F/-91°C

% VOLATILE BY WT.: 100

VAPOR PRESSURE: 12.9 mm Hg @ 20°C

EVAPORATION RATE: 1.1 (BuAc = 1)

VAPOR DENSITY: 3.1 (Air = 1)

WATER SOLUBILITY: 1.7% wt @ 20°C - slightly soluble

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## SECTION FOUR - FIRE FIGHTING DATA

NFPA Ratings (applicable to fire fighting situations only): ~~Health -2~~ ~~Flammability-3~~  
~~Reactivity-1~~

FLASH POINT: 82°F/28°C

METHOD: Closed Cup

FLAMMABLE LIMIT - LEL: 2.6%

UEL: 11.0%

APPROXIMATE IGNITION TEMPERATURE: 802°F/428°C

EXTINGUISHING MEDIA: Water spray, dry chemical, foam, carbon dioxide, or Halon system.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self contained breathing apparatus. Fight fires from an explosion-resistant location. Cool drums and tanks with water spray and continue to cool after fire has been extinguished. Stay upwind and out of low areas. If tank or truck is involved in a fire, isolate for 1/2 mile in all directions.

UNUSUAL FIRE & EXPLOSION HAZARDS: ~~Flammable liquid~~ Combustion products may contain nitrogen oxides or carbon oxides. Vapor is heavier than air and may travel a considerable distance to ignition source and flashback.

## SECTION FIVE - HEALTH & FIRST AID DATA

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH: 2300 ppm

PRIMARY ROUTES OF EXPOSURE: Inhalation of mist or vapor. Eye and skin contact.

WARNING PROPERTIES: One report of odor detectable at 5 ppm and another report of odor detectable at ~160 ppm. Consider to have poor warning properties.

HEALTH HAZARDS (ACUTE AND CHRONIC): Oral LD<sub>50</sub> for rats is 725 mg/kg Inhalation LC<sub>50</sub> for 6 hr. for rats is 400 ppm. Irritating to eyes. Chronic exposure may cause liver damage. Chronic exposure of animals indicates possible effects to the kidneys and heart. Has caused formation of methemoglobin in animal studies. In one study injection of 170 mg/kg 2-NP into female mice on days 1 through 15 of gestation caused delayed heart formation in the offspring. Weak narcotic and respiratory irritant.

CARCINOGENICITY: Based on animal studies 2-NP has been listed by IARC and NTP as a suspect carcinogen but is not listed by OSHA. Other components are not listed by NTP, IARC, or OSHA as suspect or proven carcinogen.

SIGNS & SYMPTOMS OF OVEREXPOSURE: Headache, nausea, vomiting, diarrhea, dizziness, weakness. Burning, soreness in nose, throat, or lungs.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Persons with pre-existing lung conditions may be more susceptible to irritation effects. Persons with impaired liver function may be more susceptible to effects from liver damage.

### EMERGENCY AND FIRST AID PROCEDURES:

Eye Contact: Immediately flush with large quantities of water for at least 15 minutes while holding the eyelids open. Contact a physician immediately.

Skin Contact: Immediately remove contaminated clothing and flush area with large quantities of water for at least 15 minutes. Contact a physician if irritation develops.



Ingestion: Induce vomiting if patient is conscious. Do not induce vomiting in an unconscious patient. Contact a physician immediately.

Inhalation: Remove from contaminated atmosphere. If breathing has stopped, give artificial respiration then oxygen if needed. Contact a physician immediately. Effects of inhalation overexposure may not be immediately obvious. If overexposure is severe, patient should be observed for a minimum of 2 days.

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#### SECTION SIX - REACTIVITY DATA

STABILITY: Stable.

CONDITIONS TO AVOID: High temperatures cause decomposition. Unlike nitromethane and nitroethane, no detonations of 2-NP have been reported even under very severe test conditions. However, mixing with amines, alkalies, acids, and other materials will cause 2-NP to become unstable.

INCOMPATIBILITY WITH OTHER MATERIALS: Amines, strong acids, alkalies (lye, caustic), strong oxidizers, metal oxides, hydrocarbons and other combustible materials. Lead, copper, and their alloys.

HAZARDOUS DECOMPOSITION PRODUCTS: Nitrogen oxides, carbon oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID UNCONTROLLED POLYMERIZATION: N.A.

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#### SECTION SEVEN - SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN TO HANDLE SPILLS OR RELEASES: Evacuate area of nonessential personnel. Ventilate area. Eliminate ignition sources. No flames, sparks or flares allowed in spill area. Vapor may collect in low areas or travel a considerable distance to ignition source and flash back. Prevent from entering drinking water supplies or streams. Collect with non-combustible absorbent material and package for disposal according to local, state, and federal regulations.

WASTE DISPOSAL PROCEDURES: When disposing of pure product as a waste according to EPA regulation 40 CFR 261 classify and label as follows:

DOT Name and Number = Waste Nitropropane, UN2608

EPA Name and Number = Ignitable, No. = D001

---

#### SECTION EIGHT - SPECIAL PROTECTION INFORMATION

VENTILATION: Appropriate exhaust ventilation for the handling conditions is recommended. Dilution ventilation is not recommended as the sole control mechanism.

PROTECTIVE EQUIPMENT: Minimum - chemical safety goggles with side shields and impervious gloves. Do not wear contact lenses when handling chemicals. Wear impervious clothing if possibility of body contact exists.

RESPIRATORY PROTECTION: Use pressure-type supplied air or self-contained breathing apparatus. Do not use cartridge-type respirators.



---

**SECTION NINE - SPECIAL PRECAUTIONS**

**WORK/HYGIENIC PRACTICES:** Before entering a confined space, check for vapor accumulation. Wash thoroughly after handling. Wash contaminated clothes before re-use. Launder work clothes separately from family clothes. Check protective clothing, especially impervious gloves, for leaks before use. Transfer equipment must be grounded. Do not use lye or caustic to clean drums or equipment that has contacted 2-NP. Dry salts of inorganic bases and 2-NP are explosive.

**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:** Store in cool, dry, and well ventilated area. Keep containers closed to maintain nitrogen blanket. Use only DOT-approved containers. Do not enter storage area unless area is adequately ventilated. Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Nitropropane storage areas should be isolated from flammable liquids or gases. Explosives and hazardous processing should not be permitted in the vicinity of this storage area. Separate from oxidizing materials. Dry product may be stored in steel. Wet product (>2% water) must be stored in stainless steel or aluminum.

---

**SECTION TEN - REGULATORY COMMENTS**

2-Nitropropane is not a hazardous substance (40 CFR 116), toxic pollutant (40 CFR 129), or "priority pollutant" pursuant to the Federal Water Pollution Control Act, sections 311 (b)(2)(A), 307 (a).

2-Nitropropane is not a hazardous air pollutant (40 CFR 61) pursuant to the Clean Air Act, section 112.

2-Nitropropane is minimally photochemically reactive and, therefore, is classified as a solvent exempt from volume restrictions under Rule 66 of the Air Pollution Control District of Los Angeles County, Regulation 3 of the Bay Area Pollution Control District, or other similar pollution legislation in the United States.



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Lexington, Mass. 02173

# MATERIAL SAFETY DATA

EMERGENCY TELEPHONE NO: 713 - 479 - 7348

Page: 1 of 4

**SECTION ONE - PRODUCT DESCRIPTION**IDENTITY: 1-Nitropropane<sup>7</sup>

MSDS DATE: 01-20-88

SYNONYMS: 1-NP

CHEMICAL FORMULA:  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NO}_2$ CAS Number: 108-03-2<sup>7</sup>

TSCA LISTING: This product is listed in the TSCA inventory.

**SECTION TWO - HAZARDOUS INGREDIENTS**

CHEMICAL NAME [CAS NUMBER]	PERCENT PRESENT	TLV*	PEL
1-Nitropropane [108-03-2]	>94	25 ppm TWA	25 ppm TWA
2-Nitropropane [79-46-9]	<3	10 ppm TWA	25 ppm TWA
Nitromethane [75-52-5]	<1	100 ppm TWA	100 ppm TWA
Nitroethane [79-24-3]	<1	100 ppm TWA	100 ppm TWA

\*Also Grace Internal Limit unless otherwise specified

N.A. = Not applicable

N.E. = None established

NAIF = No applicable information found

TLV = Threshold Limit Value

PEL = Permissible Exposure Limit  
(OSHA legal limit)

(ACGIH guideline)

TWA = Time Weighted Average

C = Ceiling value

for 8 hrs unless otherwise specified

LEL = Lower Explosive Limit

UEL = Upper Explosive Limit

**SECTION THREE - PHYSICAL DATA**

APPEARANCE AND ODOR: Colorless liquid with mild, fruity odor.

BOILING POINT: 268°F/131°C

SPECIFIC GRAVITY: 1.00 (Water = 1)

FREEZING POINT: -162°F/-108°C

% VOLATILE BY WT.: 100%

VAPOR PRESSURE: 7.5 mm Hg @ 20°C

EVAPORATION RATE: 0.88 (BuAc = 1)

VAPOR DENSITY: 3.1 (Air = 1)

WATER SOLUBILITY: 1.4% wt @ 20°C

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---

**SECTION FOUR - FIRE FIGHTING DATA**

NFPA Ratings (applicable to fire fighting situations only): Health -2, Flammability-3, Reactivity-1

FLASH POINT: 96°F/36C

METHOD: Closed Cup

FLAMMABLE LIMIT - LEL: 2.2%

UEL: Unknown

APPROXIMATE IGNITION TEMPERATURE: 789°F/421C

EXTINGUISHING MEDIA: Water spray, dry chemical, foam, carbon dioxide, or Halon system.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self contained breathing apparatus. Fight fires from an explosion-resistant location. Cool drums and tanks with water spray and continue to cool after fire has been extinguished. Stay upwind and out of low areas. If tank or truck is involved in a fire, isolate for  $1/2$  mile in all directions.

UNUSUAL FIRE & EXPLOSION HAZARDS: Flammable liquid. Combustion products may contain nitrogen oxides or carbon oxides. Vapor is heavier than air and may travel a considerable distance to ignition source and flashback.

---

**SECTION FIVE - HEALTH & FIRST AID DATA**

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH: 2300 ppm

PRIMARY ROUTES OF EXPOSURE: Inhalation of mist or vapor. Eye and skin contact.

WARNING PROPERTIES: Irritating to eyes > 100 ppm. Not considered to have good warning properties.

HEALTH HAZARDS (ACUTE AND CHRONIC): Oral LD<sub>50</sub> for rats is 455 mg/kg. Inhalation LC<sub>50</sub> for 6 hr. for rats is 400 ppm. Chronic exposure has caused severe liver damage and possible effects to the kidneys and heart in animals. 1-NP has caused formation of methemoglobin in animal studies. Weak narcotic and respiratory irritant. No effects attributed to 1-NP have been reported in humans except eye irritation >100 ppm.

CARCINOGENICITY: Based on animal studies 2-nitropropane, a component, has been listed by IARC and NTP as a suspect carcinogen but is not listed by OSHA. Other components are not listed by NTP, IARC, or OSHA as suspect or proven carcinogens.

SIGNS & SYMPTOMS OF OVEREXPOSURE: Headache, nausea, vomiting, diarrhea, dizziness, weakness. Burning, soreness in nose, throat, or lungs.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Persons with pre-existing lung conditions may be more susceptible to irritation effects. Persons with impaired liver function may be more susceptible to effects from liver damage.

**EMERGENCY AND FIRST AID PROCEDURES:**

Eye Contact: Immediately flush with large quantities of water for at least 15 minutes while holding the eyelids open. Contact a physician immediately.

Skin Contact: Immediately remove contaminated clothing and flush area with large quantities of water for at least 15 minutes. Contact a physician if irritation develops.



Ingestion: Induce vomiting if patient is conscious. Do not induce vomiting in an unconscious patient. Contact a physician immediately.

Inhalation: Remove from contaminated atmosphere. If breathing has stopped, give artificial respiration then oxygen if needed. Contact a physician immediately.

---

## SECTION SIX - REACTIVITY DATA

STABILITY: Stable.

CONDITIONS TO AVOID: High temperatures cause decomposition. Unlike nitromethane and nitroethane, no detonations of 1-NP have been reported even under very severe test conditions. However, mixing with amines, alkalies, acids, and other materials will cause 1-NP to become unstable.

INCOMPATIBILITY WITH OTHER MATERIALS: Amines, strong acids, alkalies (lye, caustic), strong oxidizers, metal oxides, hydrocarbons and other combustible materials. Lead, copper and their alloys.

HAZARDOUS DECOMPOSITION PRODUCTS: Nitrogen oxides, carbon oxides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID UNCONTROLLED POLYMERIZATION: N.A.

---

## SECTION SEVEN - SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN TO HANDLE SPILLS OR RELEASES: Evacuate area of nonessential personnel. Ventilate area. Eliminate ignition sources. No flames, sparks or flares allowed in spill area. Vapor may collect in low areas or travel a considerable distance to ignition source and flash back. Prevent from entering drinking water supplies or streams. Collect with non-combustible absorbent material and package for disposal according to local, state, and federal regulations.

WASTE DISPOSAL PROCEDURES: When disposing of pure product as a waste according to EPA regulation 40 CFR 261 classify and label as follows:

DOT Name and Number = Waste Nitropropane, UN2608

EPA Name and Number = Ignitable, D001

---

## SECTION EIGHT - SPECIAL PROTECTION INFORMATION

VENTILATION: If necessary, appropriate exhaust ventilation for the handling conditions is recommended. Dilution ventilation is not recommended as the sole control mechanism.

PROTECTIVE EQUIPMENT: Minimum - chemical safety goggles with side shields and impervious gloves. Do not wear contact lenses when handling chemicals. Wear impervious clothing if possibility of body contact exists.

RESPIRATORY PROTECTION: Use pressure-type supplied air or self-contained breathing apparatus. Do not use cartridge-type respirators.

---

**SECTION NINE - SPECIAL PRECAUTIONS**

**WORK/HYGIENIC PRACTICES:** Before entering a confined space, check for vapor accumulation. Wash thoroughly after handling. Wash contaminated clothes before re-use. Launder work clothes separately from family clothes. Check protective clothing, especially impervious gloves, for leaks before use. Transfer equipment must be grounded. Do not use lye or caustic to clean drums or equipment that has contacted 1-NP. Dry salts of inorganic bases will cause 1-NP to become unstable.

**PRECAUTIONS TO BE TAKEN IN STORAGE:** Store in cool, dry, and well ventilated area. Keep containers closed. Use only DOT-approved containers. Do not enter storage area unless area is adequately ventilated. Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Nitropropane storage areas should be isolated from flammable liquids or gases. Explosives and hazardous processing should not be permitted in the vicinity of this storage area. Separate from oxidizing materials. Dry product may be stored in steel. Wet product (>2% water) must be stored in stainless steel or aluminum.

---

**SECTION TEN - REGULATORY COMMENTS**

1-Nitropropane is not a hazardous substance (40 CFR 116), toxic pollutant (40 CFR 129), or "priority pollutant" pursuant to the Federal Water Pollution Control Act, sections 311 (b)(2)(A), 307 (a).

1-Nitropropane is not a hazardous air pollutant (40 CFR 61) pursuant to the Clean Air Act, section 112.

1-Nitropropane is minimally photochemically reactive and, therefore, is classified as a solvent exempt from volume restrictions under Rule 66 of the Air Pollution Control District of Los Angeles County, Regulation 3 of the Bay Area Air Pollution Control District, or other similar pollution legislation in the United States.



Eagle River Chemical Corp.  
West Helena, Arkansas



SOIL LABORATORY  
ENGINEERING REPORT

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WEST HELENA, AR 72390  
(501) 572-3701

SEPTEMBER 29, 1981

## SITE AND CLIMATIC DATA

1. WEST HELENA, ARKANSAS
2. 190 FEET ABOVE SEA LEVEL
3. AVERAGE ANNUAL TEMPERATURE - 62.7° F  
WINTER DESIGN - 20°F DRY BULB  
SUMMER DESIGN - 95°F DRY BULB  
- 78°F WET BULB  
PREVAILING WIND, SOUTH WEST  
AVERAGE SPEED 8 MPH
4. CLIMATIC DATA FROM NATIONAL CLIMATIC CENTER

### A. RAINFALL AND EVAPORATION (20 YEARS OF RECORD)

<u>MONTH</u>	<u>PRECIP(IN)</u>	<u>EVAPORATION(IN)</u>	<u>NET ACCUMULATION(IN)</u>
JANUARY	4.72	1.29	+ 3.43
FEBRUARY	4.84	1.74	+ 3.10
MARCH	5.43	3.30	+ 2.13
APRIL	5.30	4.53	+ 0.77
MAY	4.25	5.78	- 1.53
JUNE	3.23	6.79	- 3.56
JULY	3.73	6.85	- 3.12
AUGUST	3.07	6.59	- 3.46
SEPTEMBER	3.27	5.01	- 1.74
OCTOBER	2.91	3.47	- 0.56
NOVEMBER	4.09	2.10	+ 1.99
DECEMBER	<u>4.82</u>	<u>1.30</u>	<u>+ 3.52</u>
	49.66	48.70	+ 0.96



PAGE 2, SITE AND CLIMATIC DATA

B. SUMMARY

- |  |        |
|--|--------|
| 1. ACCUMULATION FROM NOVEMBER TO APRIL | +14.94 |
| 2. ACCUMULATION FROM MAY TO OCTOBER    | -13.98 |



VERTAC CHEMICAL CORPORATION  
24th Floor • 5100 Poplar • Memphis, TN 38137 • 901-767-6851

REPLY TO: P. O. BOX 2648  
WEST HELENA, AR 72390  
(501) 572-3701

SEPTEMBER 29, 1981

#### MONITORING WELLS - ANALYTICAL DATA

BEGINNING IN JULY 1977, A PROGRAM WAS INITIATED TO ANALYZE WATER OBTAINED FROM THE MONITORING WELLS. THE PURPOSE OF THIS ANALYSIS IS TO DETECT MIGRATION OF CONTAMINANTS FROM THE WASTEWATER TREATMENT FACILITY OR THE MANUFACTURING AREA. GENERAL PARAMETERS ARE EXAMINED TO PROVIDE AN EARLY WARNING; NONSPECIFIC ORGANIC PARAMETERS PROVIDE SCREENING; AND SPECIFIC CHEMICAL COMPOUNDS DETERMINE THE SOURCE OF CONTAMINATION.

ROUTINE LABORATORY ANALYSIS IS PERFORMED ON AT LEAST TWO WELLS ON THE FIRST OF EACH MONTH. PARAMETERS ANALYZED FOR INCLUDE THE FOLLOWING:

PH	NITRATES
COD	SULFATES
BOD	AMMONIA
ALKALINITY	PHENOL(S)
CHLORIDES	SPECIFIC PRODUCTS

SPECIFIC PRODUCTS INCLUDES ANY PRODUCT MANUFACTURED OR HANDLED CURRENTLY OR WITHIN THE PAST TWELVE MONTHS.

ANALYSIS IS PERFORMED IN ACCORDANCE WITH THE CURRENT EDITION OF "STANDARD METHODS OF WATER AND WASTEWATER", CURRENTLY ACCEPTED EPA METHODS, OR IN THE CASE OF SPECIFIC PRODUCTS, METHODS DEVELOPED BY VERTAC CHEMICAL CORPORATION.





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(501) 572-3701

SEPTEMBER 29, 1981

#### EXISTING MONITORING WELLS- LOCATION AND STRUCTURE

DURING CONSTRUCTION OF THE WEST HELENA PLANT'S WASTE-WATER TREATMENT FACILITY IN 1976, THREE (3) MONITORING WELLS WERE ESTABLISHED IN SEPTEMBER OF THAT YEAR. THE WELLS ARE LOCATED ON THREE SIDES OF THE TREATMENT SYSTEM; EAST, SOUTH AND WEST. THE SOUTH AND WEST WELLS ARE 20 FEET DEEP WHILE THE SOUTH WELL IS 45 FEET DEEP. THE WELLS WERE CONSTRUCTED WITH STANDARD 1 1/4" WELL PIPE BY JUMPER'S WELL SERVICE OF WEST HELENA. NO LOGS OF BORING WERE MADE. THESE WELLS ARE HYDRAULICALLY DOWN GRADIENT AND AT THE LIMIT OF THE FACILITY PROPERTY.

A FOURTH WELL LIES HYDRAULICALLY UPGRADIENT FROM THE WASTE MANAGEMENT AREA AND IS AN OLD WATER SOURCE FOR THE PLANT SITE. THE WELL IS APPROXIMATELY 81 FEET DEEP.

THE WELLS ARE IDENTIFIED IN THE FOLLOWING MANNER:

- WELL NO. 1 - EAST SIDE OF TREATMENT SYSTEM  
(BY API TANK)
- WELL NO. 2 - BESIDE BOILER HOUSE
- WELL NO. 3 - WEST SIDE OF TREATMENT SYSTEM
- WELL NO. 4 - SOUTH SIDE OF TREATMENT SYSTEM.



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SEPTEMBER 29, 1981

WASTEWATER TREATMENT SYSTEM - CONSTRUCTION DETAILS

	<u>DIMENSIONS</u>	<u>DEPTH</u> <u>WHEN FULL</u>	<u>APPROX.</u> <u>FULL VOLUME</u>
EQUALIZATION POND	295' X 353'	15'	1075 M FT <sup>3</sup> 8 MM GAL
BIO-POND	127' X 262'	15'	240 M FT <sup>3</sup> 0.6 MM GAL
POLISH POND	206' X 262'	15'	480 M FT <sup>3</sup> 3.6 MM GAL

SIDE SLOPES AT 3:1

PONDS ARE LINED WITH AMERICAN COLLOID COMPANY, VOLCLAY SALINE SEAL-100, BENTONITE CLAY. CLAY APPLIED AT A MINIMUM OF 2.5 POUNDS OF CLAY TO EACH SQUARE FOOT OF SOIL, SPREAD EVENLY, MIXED INTO THE TOP FOUR INCHES OF SOIL AND COMPACTED, AT OPTIMUM MOISTURE TO A MINIMUM OF 85 MODIFIED PROCTOR, FOR A PERMEABILITY OF  $1 \times 10^{-7}$  CMS/SEC.



ECOLOGY AND ENVIRONMENT, INC.,

REGION VI

MEMORANDUM

p-35 28110  
cedar chemical  
ARD 990660649  
2-16-90

TO: Keith Bradley, Region VI RPO

FROM: Miles Bolton, Ground Water Hydrologist *MWB*

THRU: K. H. Malone, Jr., Region VI RPM *KHM*

DATE: July 29, 1986

SUBJ: Sampling Mission Results from the Vertac-West Helena Site,  
West Helena, AR (AR 361)  
TDD# R06-8507-13

INTRODUCTION

FIT was tasked by the USEPA to conduct a sampling mission at the Vertac-West Helena site, West Helena, Arkansas, Figure 1. It was specifically requested that both surface and subsurface soil samples be collected at three inactive surface impoundments located along Vertac's northwestern boundary. It was agreed that three sample stations would be established for each impoundment area.

SITE DESCRIPTION AND HISTORY

On October 19, 1985, FIT members Miles Bolton, Weldon Day and Jeff Dubose met with site representative Joe Porter to discuss the following day's sampling mission and obtain additional site information. A summary of the site history follows:

A man named Kencade started operations at this site around 1970 manufacturing methoxychlor. At that time, ponds were present where the inactive surface impoundments are now located. In 1972 the chemical plant was sold to Jerry Williams who sold the plant to ANSEL later in 1972. In 1973 the plant was again purchased by Jerry Williams. By 1973 the plant was known as Eagle River Chemical. The name was later changed to Vertac, Inc. The predominant chemicals manufactured in the past were dinitro herbicide and propanil. The major chemicals currently being manufactured are methymil, permethrin, supermethrin, and a hydrocarbon polymer that is composed of kerosine and I sonax 132. Mr. Porter claims that the yellow blocks scattered throughout the inactive portion of the site are where ANSEL buried dinitro drums.

The surface impoundments were created from the ponds around 1972-73. Limestone was added to the narrow impoundment for the acid neutralization of

Reviewed by GWM-SG  
of form date 1/5/86



dichloromaline and proprionic acid. The other two ponds were used as waste disposal. Wash water from Helena Chemical's (AR 1589) chemical formulation operations was also placed into the ponds. Helena Chemical stopped disposing of their wastes in the ponds around 1976-77.

The ponds were closed in 1978. The closure procedure consisted of pumping the water from the pond (the water was removed by Rollins) and then placing a clay cap consisting of native soil and bentonite over the impoundments. An aerial photograph owned by Vertac indicates the narrow pond was approximately 2-4 feet deep and the other two ponds were approximately 5 to 10 feet deep.

#### SAMPLING RESULTS

Nine surface and nine subsurface samples were collected by FIT members Miles Bolton, Weldon Day, Jeff Dubose, Thomas Lensing and Lloyd Collins on October 20, 1985. Their locations are shown in Figure 3. The subsurface samples were collected using post hole diggers. Since the maximum depth obtainable with post hold diggers is about 5 feet, the samples were collected along the sides of the ponds to ensure penetrating the fill material used to cover the ponds. In all cases, the subsurface soil samples were collected after a lithologic change in the soil profile was evident, indicating the subsurface samples consisted of non-fill material.

Organic and inorganic laboratory results, field sample documents and photographs are attached to this report. The sample stations were lettered A through I. The number 1 was added as a suffix to each letter to indicate surface samples and the number 2 was added to indicate subsurface samples. Note in the laboratory results that organic samples from Stations D1, G-2, H1 and I2 had to be analyzed as medium concentration samples by the laboratory. Table 1 summarizes the organic surface sample results and Table 2 summarizes the organic subsurface sample results. These tables do not list any compounds that were flagged as being present in laboratory blanks, tentatively identified, or below detection limits. Therefore, only those compounds positively identified as being present in the samples are listed.

The organic sample results indicate that the surface fill material for pond #1 is more contaminated than the subsurface material, especially at Station B. The opposite is true for ponds 2 and 3. Only pesticides were positively identified in the subsurface samples.

In contrast to the organic results, the inorganic sample results do not indicate the presence of significant inorganic contamination. The lack of a background sample, however, makes it difficult to draw definite conclusions.

#### CONCLUSIONS AND RECOMMENDATIONS

It is evident from the sample results that the subsurface material is contaminated with pesticides and other organic compounds and the surface fill material is contaminated with pesticides. Since the surface fill material is contaminated with a variety of pesticides, the possibility that the contamination extends beyond the site boundaries should be considered.



Considering the area's dependence upon ground water, the FIT recommends that monitoring wells be installed around the ponds to determine if the ground water has been affected by the organic compounds. The proposed well locations are shown in Figure 4. These locations would provide water quality and local hydraulic gradient information. Currently, FIT lacks local hydrogeologic information for the area around the site. Therefore, the specific design of the wells will be dependent upon the acquisition of additional hydrogeologic information.

If the EPA desires to determine whether or not the surface soil contamination extends beyond the fill material as a result of wind blown action or possible indiscriminate dumping, then the FIT recommends that surface soil samples be collected outside of the pond area. The proposed locations are shown in the attached aerial photograph, Figure 5. Each sample would be a composite consisting of soil collected at the station and four other locations no more than 10 feet from the station. Based upon these results, a comprehensive sampling plan could be developed to accurately determine the extent of surface pesticide contamination.

Table 1. Organic surface soil results from the Vertac-West Helena site (AR 361). Only results that were not flagged are shown. Concentrations are in parts per billion.

Station	A1	B1	C1	D1	E1	F1	G1	H1	I1
4,4'-DDT		1,813	26		30	34	25		
Methoxychlor	3,984	12,996	241			184	817	221	444
Aldrin		596.1						37	
Dieldrin		1,120							
Chlordane		3,563							
4,4'-DDE		421							



Table 2. Organic surface soil results from the Vertac-West Helena site (AR 361). Only results that were not flagged are shown. Concentrations are in parts per billion.

[illegible]

QA/QC

After reviewing the data obtained from samples taken at the Vertac-West Helena facility the results are as follows:

In the inorganic analysis the spike recoveries for antimony (55%), lead (65%), selenium (0%), silver (60%), tin (17%), manganese (34%) and arsenic (70%) were below QC limits. Any values reported for these metals may be biased to the low side, and actual values may be higher than reported values.

The duplicate analysis for calcium should be used cautiously. All other analysis for inorganics were satisfactory.

For the organic analysis the surrogate recoveries for samples FC284, FC285, FC286 and FC287 were outside of QC limits. These four samples were reextracted and reanalyzed, however the reanalysis was worse than the original analysis so the results from the original analysis was reported. Since the surrogates were out of QC limits both times, this may represent a real matrix interference in the samples and not a lab problem.

For sample FC291 the % RPD for the volatiles were all outside QC limits. Since this was a field rinsate blank the effect was probably minimal.

For sample FC280 the % surrogate recoveries for all fractions were slightly above QC limits. Values reported for this sample may be higher than actual values.

All compounds found in the lab blank were flagged with a B.

The tuning and calibration analysis for these samples were satisfactory.

The analysis of these samples show that each location had a variety of pesticides at varying concentrations.



## INORGANIC SOIL ANALYSIS SUMMARY

Page 1 of 3

CASE NUMBER: 4781

SITE NAME/CODE: Vertac, W. Helena AR 361

PARAMETER	CONCENTRATIONS (ppm)											AMBIENT BACKGROUND 1.	
	EPA Sample Numbers											Western U.S. 2.	Eastern U.S. 2.
	MFB341	MFB350	MFB342	MFB351	MBF343	MFB354	MFB344	MFB355	MFB345	MFB356	MFB346	Soil	Soil
Matrix type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	Soil	Soil
Aluminum	3570	3690	3710	2760	3320	3240	2870	2750	5330	6920	3000	58,000	33,000
Antimony								28R				.47	.52
Arsenic	11R	6.3R	16R	4R	6.9R	7.8R	20R	2.2R	7.2R	9.9R	4.6R	5.5	4.8
Barium	111	84	144	110	90	87	109	68	118	122	88	580	290
Beryllium												0.68	0.55
Bismuth												1	1
Cadmium	13,100*	6650*	4700*	21,500*	15,200*	23,900*	16,100*	217,000*	8610*	1470*	11,900*	18,000	3,200
Chromium			5.2					5.4				41	33
Cobalt												7.1	5.9
Copper	12	8	6.1	7.5	8.2	7.6	7	4.3	6.9	9.9	6.2	21	13
Cron	10,500	10,400	8160	9530	9880	10,400	9250	5330	11,400	12,200	8670	21,000	14,000
Lead	7.8R	7.3R	9.4R	5.9R	7.4R	6.8R	6.3R	3.3R	7.7R	8.5R	7.2R	17	14
Magnesium	6850	3950	2390	11,700	8550	12,500	8850	12,300	5190	1360	6760	7,800	2,300
Manganese	627R	444R	640R	500R	636R	579R	661R	459R	582R	515R	519R	380	260
Mercury	0.081	0.038	0.095	0.067	0.079	0.050	0.057	0.019	0.048	0.083	0.067	0.046	0.081
Nickel												15	11
Potassium	483		490	2.91					828	788	379		
Selenium												.23	.30
Silver												-	-
Sodium	542	485	469	712	388	502	566	734	650	822	465	10,000	2,600
Thallium												9.1	7.7
Zinc												.90	.96
Vanadium												70	43
Inc	40	32	27	32	38	37	34	31	36	34	33	55	40
Vanide			0.54R		0.52R				0.53R	1.4R	0.60R		
Station No.	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	1. Values obtained from "Element Concentrations Soils and Other Surface Materials of the Conterminous United States", dated 1984. U.S.G.S. Professional Paper 1270.	
Sample Station Location	INACTIVE IMPOUNDMENT, NORTH POND	INACTIVE IMPOUNDMENT, NORTH POND (SUB-SURFACE)	INACTIVE IMPOUNDMENT, NORTH POND	INACTIVE IMPOUNDMENT, NORTH POND (SUB-SURFACE)	INACTIVE IMPOUNDMENT, NORTH POND	INACTIVE IMPOUNDMENT, NORTH POND (SUB-SURFACE)	INACTIVE IMPOUNDMENT, SOUTH POND	INACTIVE IMPOUNDMENT, SOUTH POND (SUB-SURFACE)	INACTIVE IMPOUNDMENT, SOUTH POND	INACTIVE IMPOUNDMENT, SOUTH POND (SUB-SURFACE)	INACTIVE IMPOUNDMENT, SOUTH POND		

-indicates a value estimated or not reported due to the presence of interference.  
 -spike sample recovery is not within control limits.  
 -duplicate analysis is not within control limits.

2. Reference for East/West Division is the 96 W longitudinal line which bisects Region VI.  
 10/31/85



P. 32.0  
110

ARD 99060649  
7-16-90

# INORGANIC SOIL ANALYSIS SUMMARY

CASE NUMBER: 4781

SITE NAME/CODE: Vertac, W. Helena AR 361

PARAMETER	CONCENTRATIONS (ppm) EPA Sample Numbers								AMBIENT BACKGROUND 1.	
	MFB357	MFB347	MFB358	MFB348	MFB359	MFB349	MFB360		Western U.S. 2.	Eastern U.S. 2.
Matrix type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL		Soil	Soil
Aluminum	4240	4020	3780	2830	4180	3640	2910		58,000	33,000
Antimony									.47	.52
Arsenic	6.6R	6.0R	58R	4.9R	7.6R	5.9R	32R		5.5	4.8
Barium	103	110	117	116	79	117	70		580	290
Beryllium									0.68	0.55
Bismuth									1	1
Boron	13,500*	11,100*	2310*	25,100*	50,500*	22,300*	96,200*		18,000	3,200
Bromine	7.9	5.1		128	8.5	7.3	6.2		41	33
Cobalt									7.1	5.9
Copper	11	8.5	11	9.9	9.4	12			21	13
Iron	9970	10,800	9350	10,500	8430	11800	5680		21,000	14,000
Lead	6.1R	8.5R	9.2R	6.4R	5.1R	6.9R	4.8R		17	14
Magnesium	7320	5940	1390	13,500	6700	11,700	3720		7,800	2,300
Manganese	439R	594R	342R	650R	274R	702R	482R		380	260
Mercury	0.070	0.063	0.075	0.045	0.084	0.070	0.042		0.046	0.081
Nickel	10			34		11			15	11
Potassium	823	277	736		975		453			
Selenium									.23	.30
Silver									-	-
Sodium	627	628	568	597	594	642	532		10,000	2,600
Strontium									9.1	7.7
Tin									.90	.96
Zinc	16					16			70	43
Vanadium	39	37	31	38	38	46	17		55	40
Chloride			0.56R							
Station No.	F2	G1	G2	H1	H2	I1	I2			
Sample Location	INACTIVE IMPOUND- MENT, SOUTH POND (SUB- SURFACE)	INACTIVE IMPOUND- MENT, WEST POND	INACTIVE IMPOUND- MENT, WEST POND (SUB- SURFACE)	INACTIVE IMPOUND- MENT, WEST POND	INACTIVE IMPOUND- MENT, WEST POND (SUB- SURFACE)	INACTIVE IMPOUND- MENT, WEST POND	INACTIVE IMPOUND- MENT, WEST POND (SUB- SURFACE)			

-Indicates a value estimated or not reported due to the presence of interference.

-spike sample recovery is not within control limits.

-duplicate analysis is not within control limits.

1. Values obtained from "Element Concentrations Soils and Other Surface Materials of the Conterminous United States", dated 1984. U.S.G.S. Professional Paper 1270.

2. Reference for East/West Division is the 96 W longitudinal line which bisects Region VI.  
10/31/85



SITE NAME/CODE: Vertac, W Helena AR 361

PARAMETER	CONCENTRATIONS (ppb) EPA Sample Numbers										Drinking Water Criteria	
	MFB352	MFB353	MFB361								Primary	Secondary
Matrix type	WATER	WATER	WATER									
Aluminum												
Antimony												
Arsenic											50	
Barium											1000	
Beryllium												
Cadmium											10	
Calcium	144*	168*	156*									
Chromium											50	
Cobalt												
Copper												1000
Cron												300
Lead											50	
Magnesium												
Manganese												50
Mercury	0.052	0.032	0.041								2	
Nickel												
Potassium												
Selenium											10	
Silver											50	
Sodium	217	222	217									
Strontium												
Tin												
Vanadium												
Zinc												5000
Yanide												
Station No.												
Sample	RINSATE	RINSATE	RINSATE									
Station	BLANK	BLANK	BLANK									
Location												

-Indicates a value estimated or not reported due to the presence of interference.

-Spike sample recovery is not within control limits.

-Duplicate analysis is not within control limits.



[illegible]

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

VOA - Volatile  
ABN - Acid Base/Neutral  
Pest - Pesticide

B - The analyte is found in the lab blank.  
J - Indicates an estimated value for tentatively identified compounds  
compounds found below detection limit.  
P - Present in sample, but not reported by lab.



Table II: ORGANIC ANALYSIS SUMMARY

Site Name/Code Vertac, W Helena AR 0361

Case Number 4781

Concentration ppb Page 1 of 4

Sample Station Number and Location	Scan No.	Fraction /Class	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2
EPA SAMPLE NUMBER			FC280	FC289	FC281	FC290	FC282	FC293	FC283	FC294	FC284	FC295	FC285	FC296
MATRIX			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	16B	SOIL
Methylene Chloride		VOA/1	9B	10B	12B	22B	9B	17B	840B	36B	21B	150B	6B	16B
Chloroform		VOA/1	7B	7B	6B	7B	7B	7B	840B	6B	6B	110B		7B
Benzene		VOA/1	7B		7B				840B	6B	6B			
Toluene		VOA/1									6J			
1,1,1-trichloroethane		VOA/1		7J		7J								
1,1-dichloroethane		VOA/1										190		
Ethylbenzene		VOA/1												
Chlorobenzene		VOA/1												
Acetone		VOA/2				14B		13B	150B		12B		12B	12B
Total xylenes		VOA/2												
2-hexanone		VOA/2												
N-nitrosodiphenylamine		ABN/1	459J			465J	465J	436J		405J		475J		2078J
Phenol		ABN/1								1800		840		
1,2-dichlorobenzene		ABN/1								405J				
Bis-(2-ethylhexyl) phthalate		ABN/1				670		4900		405J		475J		
4,4-DDT		Pest/1			1813		26	22			30		14	
4,4-DDF		Pest/1			421									
Methoxychlor		Pest/1	3984	216	12,996		241	104.6J	106.8J	85,121	99.6J	114J	184	5659
Aldrin		Pest/1			596.1									1073.6
Dieldrin		Pest/1			1120			20.9J				22.8J		
Chlordane		Pest/1			3563									14,360
Gamma-BHC (lindane)		Pest/1										98.3		
Hexamethylcyclotrisiloxane		VOA/3	92JB	31JB	340JB	30JB	74JB	44JB	1500JB	22.2	190JB	280JB	36JB	20JB
Methoxybenzene		VOA/3					9J			1100J				13J
Unknown	62	VOA/3							1600J					
Unknown Alkane	247	VOA/3								400J				
Unknown Alkane	263	VOA/3								84J				
Unknown Alkane	441	VOA/3								9J				
1,2-dichloro-3-nitrobenzene		ABN/3												
Unknown Alkane	1510	ABN/3	590J				420J					380J	650J	
Unk. carboxylic acid	1518	ABN/3	390J				960J						450J	
Unk. polynuclear aromatic	1937	ABN/3	1000J											
Unknown Alkane	2222	ABN/3	1100J						280J				460J	
Unknown Alcohol	530	ABN/3		230J				80J				390J		
Unknown Amine	1798	ABN/3		230J				30J			300J		720J	
Unknown	1842	ABN/3		290J	2600J			1100J						
Unknown	508	ABN/3			2100J									
Unknown Ketone	1684	ABN/3			2500J		1100J							
Unknown Alkane	1677	ABN/3				260J						580J	660J	
Unknown	2394	ABN/3					810J					1400J	130J	
Unk. Substituted Benzene	401	ABN/3											240J	
Unknown Alkane	1025	ABN/3								1300J				
Unknown Alkane	1218	ABN/3								480J				
Unknown Alkane	1456	ABN/3								510J				
Unknown Amine	1580	ABN/3								1000J				
Unknown	1364	ABN/3								1100J				1700J
Unk. Carboxylic Acid		ABN/3										340J		
Unknown Alkane	1941	ABN/3											1700J	

1. Priority Pollutant.

2. Specific Hazardous Substance.

3. Tentatively Identified.

VOA - Volatile

ABN - Acid Base/Neutral

Pest - Pesticide

B - The analyte is found in the lab blank.

J - Indicates an estimated value for tentatively identified compounds found below detection limit.

P - Present in sample, but not reported by lab.



Site Name/Code

Case Number 4781

Concentration ppb

Page 2 of 4

[illegible]

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

VOA - Volatile  
ABN - Acid Base/Neutral  
Pest - Pesticide

B - The analyte is found in the lab blank.  
J - Indicates an estimated value for tentatively identified compounds  
compounds found below detection limit.  
P - Present in sample, but not reported by lab.



Site Name/Code Vertac, W. Helena AR 0361

Table II: ORGANIC ANALYSIS SUMMARY  
Case Number 4781

Concentration pp\_b Page 3 of 4

Sample Station Number and Location	Scan No.	Fraction /Class	G1	G2	H1	H2	I1	I2						
EPA SAMPLE NUMBER			FC286	FC297	FC287	FC298	FC288	FC299						
MATRIX			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL						
Methylene Chloride		VOA/1	15B	2700B	2300B	3300B	17B	1710B						
Chloroform		VOA/1	7B	845B	790B		7B	1710B						
Benzene		VOA/1	7B	845B				1710B						
Toluene		VOA/1		4000	790J	34,000		16,000						
1,1-trichloroethane		VOA/1					7J							
1,2-dichloroethane		VOA/1												
Ethylbenzene		VOA/1		845J		1600J		28,000						
Chlorobenzene		VOA/1						2600						
Acetone		VOA/2	13B	5200B	4600B		42B							
Total xylenes		VOA/2		1700		3300		180,000						
2-hexanone		VOA/2				75,000		75,000						
N-nitrosodiphenylamine		ABN/1	444J	2254J				13,680J						
Phenol		ABN/1		3100										
1,2-dichlorobenzene		ABN/1		2254J				30,000						
Bis(2-ethylhexyl) phthalate		ABN/1					440J							
4,4-DDT		Pest/1	25				21.3J							
4,4-DDE		Pest/1												
Methoxychlor		Pest/1	817	17,266	221		444	654,178						
Aldrin		Pest/1			37									
Dieldrin		Pest/1												
Chlordane		Pest/1												
Gamma-BHC (lindane)		Pest/1						4980						
Hexamethylcyclotrisiloxane		VOA/3	85JB	520JB	930JB	1000JB	860JB	46JB						
Methoxybenzene		VOA/3		28,000J		200,000J		140,000J						
Unknown	62	VOA/3		850J	2000J			2000J						
Unknown Alkane	247	VOA/3												
Unknown Alkane	263	VOA/3												
Unknown Alkane	441	VOA/3												
1,2-dichloro-3-nitrobenzene		ABN/3		15,000J				740,000J						
Unknown Alkane	1510	ABN/3												
Unk. carboxylic acid	1518	ABN/3												
Unk. polynuclear aromatic	1937	ABN/3												
Unknown Alkane	2222	ABN/3												
Unknown Alcohol	530	ABN/3					310J							
Unknown Amine	1798	ABN/3	250J				740J							
Unknown	1842	ABN/3	270J	1900J			230J							
Unknown	508	ABN/3												
Unknown Ketone	1684	ABN/3												
Unknown Alkane	1677	ABN/3												
Unknown	2394	ABN/3												
Unk. Substituted Benzene	401	ABN/3		3300J			380J	56,000J						
Unknown Alkane	1025	ABN/3		1900J				71,000J						
Unknown Alkane	1218	ABN/3												
Unknown Amine	1456	ABN/3		2200J				24,000J						
Unknown	1580	ABN/3												
Unk. Carboxylic Acid	1364	ABN/3												
Unknown Alkane	1941	ABN/3												

1. Priority Pollutant.

2. Specified Hazardous Substance.

3. Tentatively Identified.

VOA - Volatile

ABN - Acid Base/Neutral

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Cedar Chemical  
ARD 990660649  
2-16-90

Table II: ORGANIC ANALYSIS SUMMARY  
Case Number 4781

Site Name/Code    Vertac W. Helena AR 361

Case Number 4781

Concentration ppb

Page 4 of 4

Sample Station Number and Location			G1	G2	H1	H2	I1	I2						
Compound	Scan No.	Fraction /Class												
EPA SAMPLE NUMBER														
MATRIX														
Unknown	1993	ABN/3												
Unknown Alkane	2002	ABN/3												
Unkn	2320	ABN/3												
Unkn	2345	ABN/3												
Unkn	1526	ABN/3												
Unkn	1544	ABN/3												
Unknown Alcohol	1558	ABN/3												
Unk. Carboxylic Acid	1752	ABN/3												
Unknown	1403	ABN/3	1900J	1200J				45,000J						
Unk. Substituted Benzene	1412	ABN/3			2700J		7700J							

1. Priority Pollutant.
2. Specified Hazardous Substance.
3. Tentatively Identified.

VOA - Volatile  
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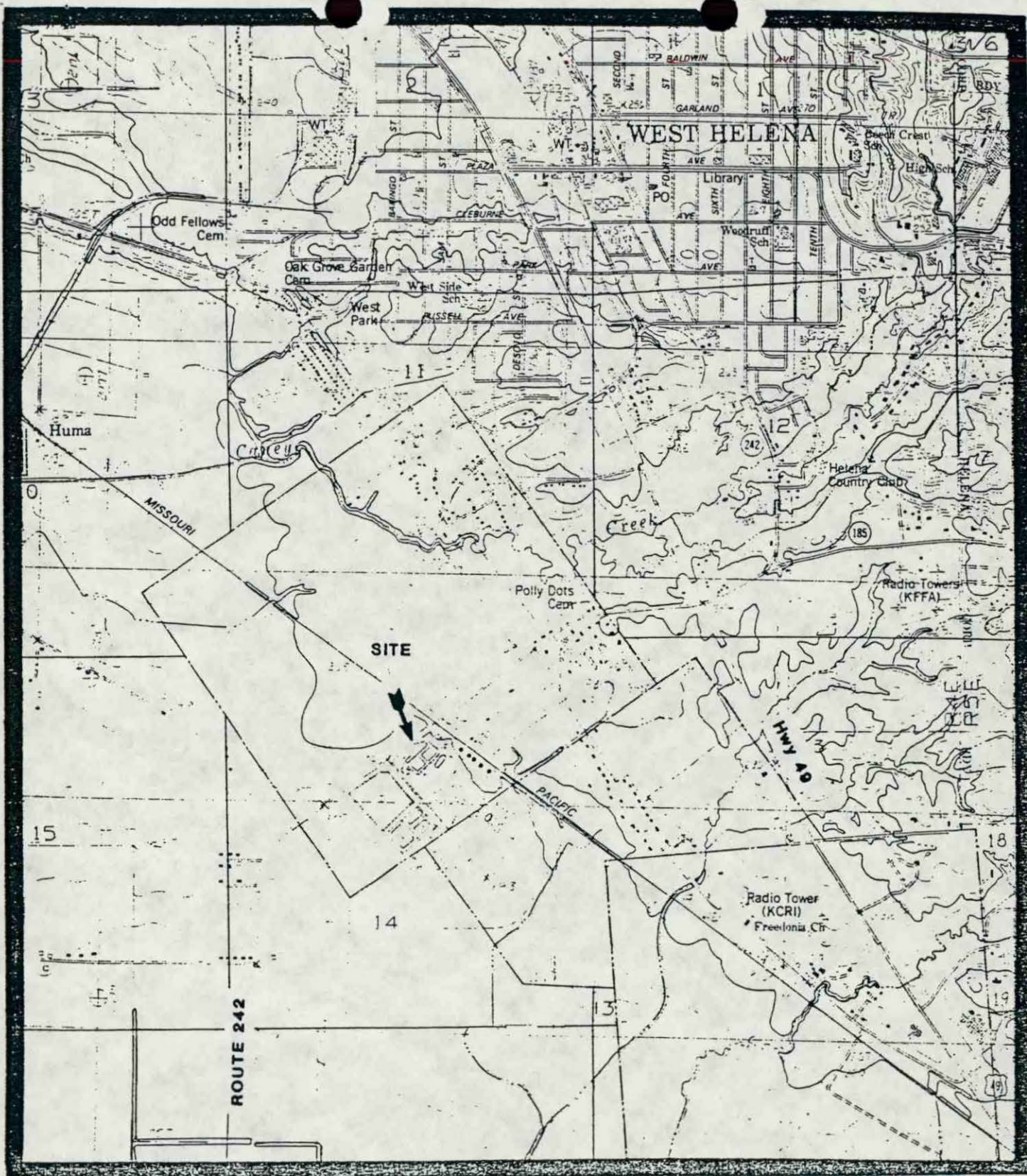


Figure 1. Site location map for the Vertac-West Helena site in West Helena, Arkansas (AR 361).

Scale: 1 inch  $\approx$  2,000 Ft.



AR 990660649  
2-16-90

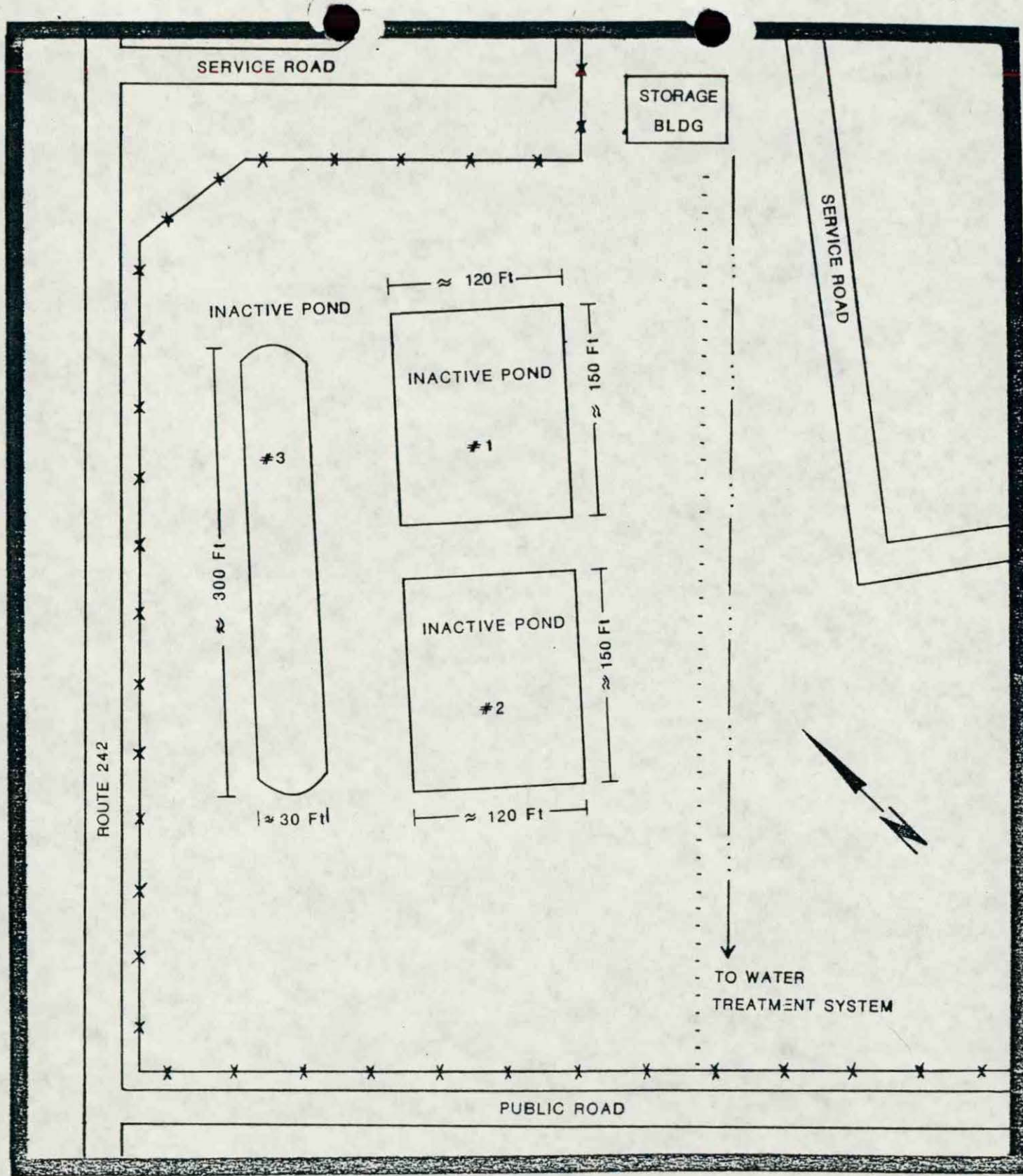


Figure 2. Site sketch of the inactive ponds located at the Vertac-West Helena site (AR 361). The pond boundaries and dimensions are estimates.

- - - Berm
- ← ... → Open culvert
- \* - \* Fence

Not drawn to scale



4-41 of 110  
 Review Location  
 ARD 910606049  
 2-16-90

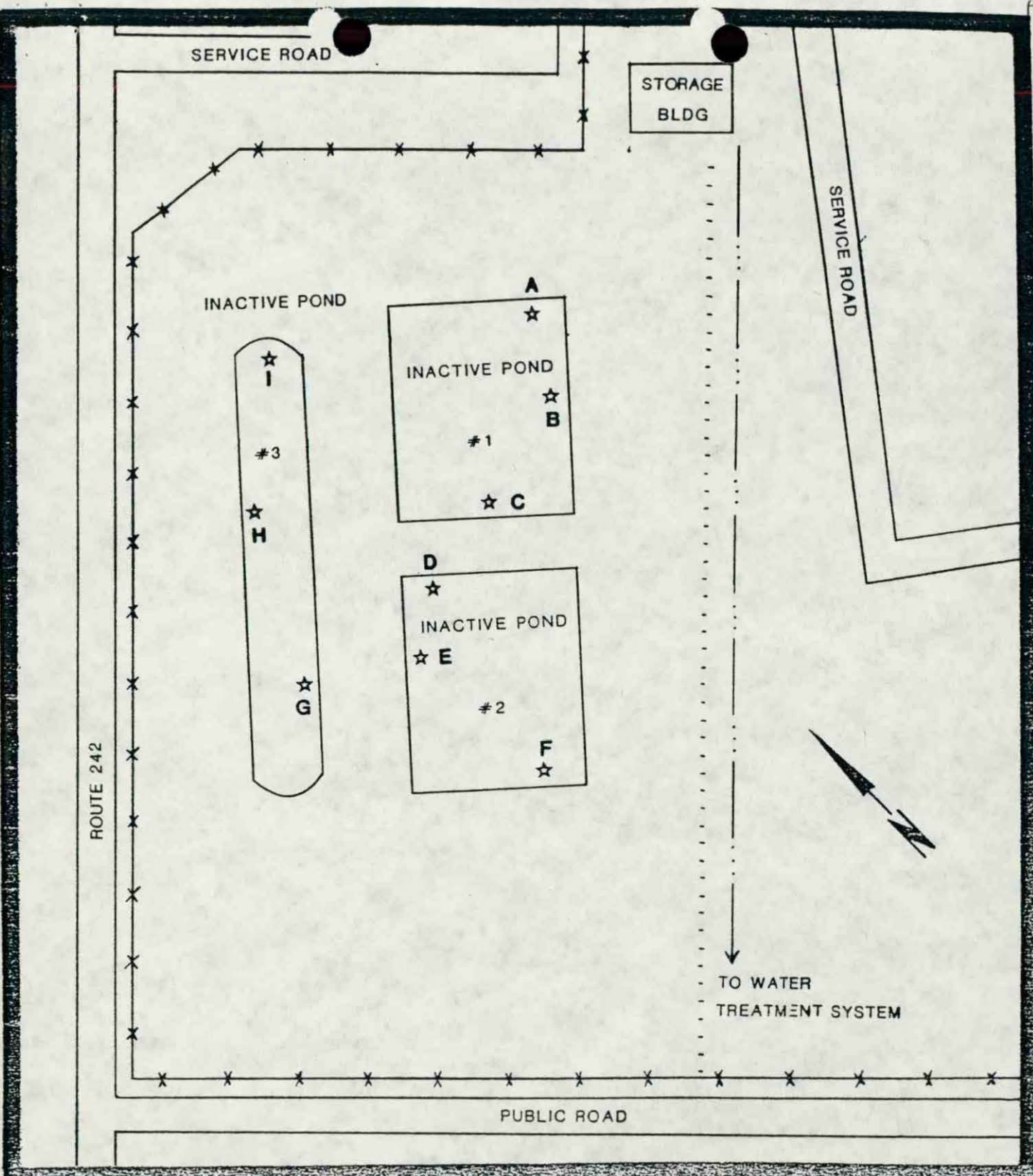


Figure 3. Sample station locations at the Vertac-West Helena site (AR 361).

- ☆ Sample stations
- X—X Fence
- - - - - Term
- ← ... — Open culvert

Not drawn to scale

p. 42 of 110  
 ARD 99060649  
 2-16-90

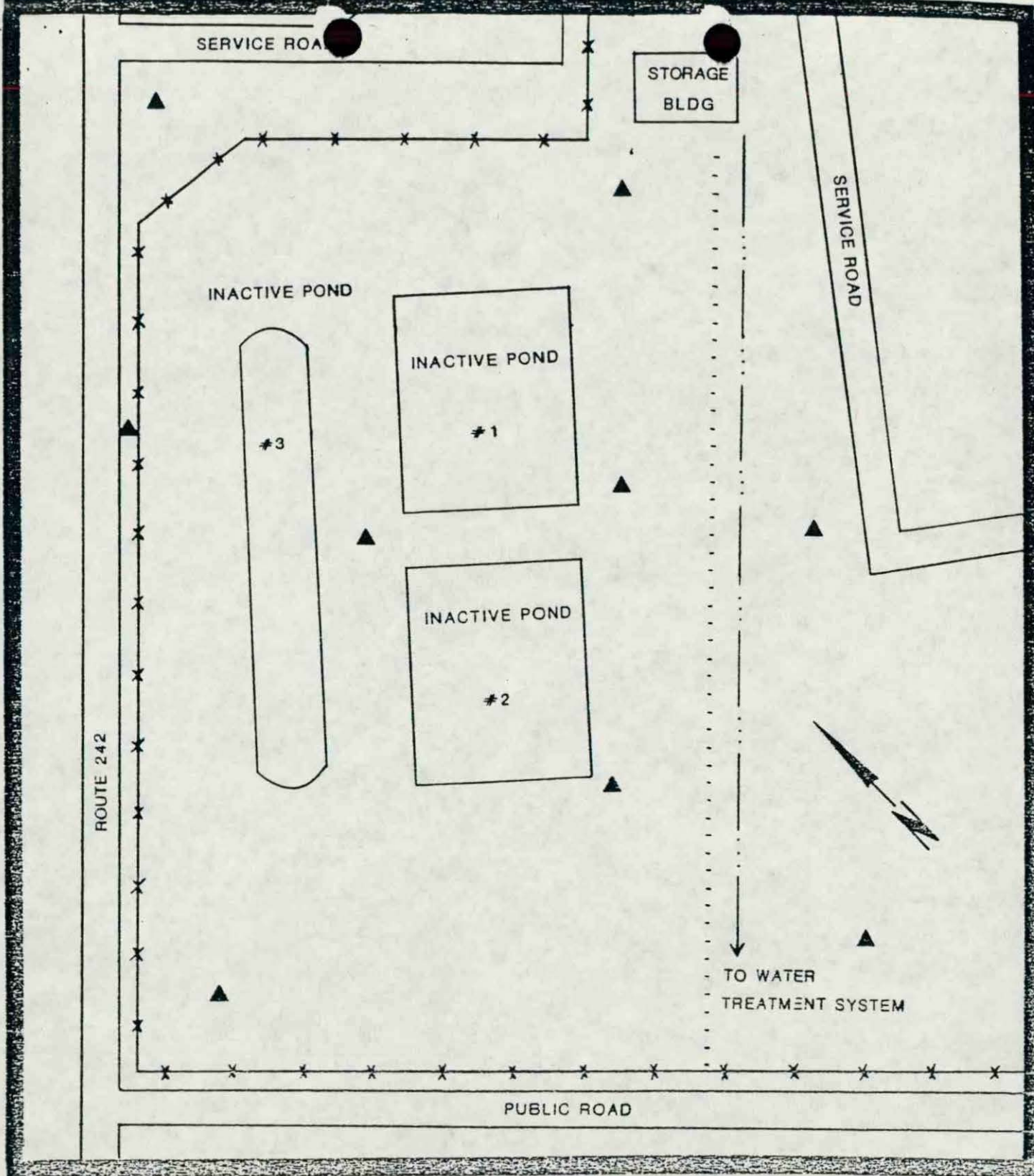


Figure 4. Proposed monitoring well locations for the Vertac-West Helena site (AR 361).

- ▲ Well locations
- - - Berm
- X — X Fence
- ← ... — Open culvert

Not drawn to scale



ARKANSAS DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY

MEMORANDUM

TO : Sammy Bates, Inspector, Hazardous Waste Div.  
FROM : Jay Justice, Hazardous Waste Chemist, T.S. JJ  
DATE : 27-OCT-1988  
SUBJECT : Results from analyses on soil samples taken at Cedar Chemical on August 22, 1988

Six of the seven soil samples taken at Cedar Chemical Company on August 22, 1988, were extracted with an organic solvent and presented to the GC/MS to determine if any semi-volatile organic compounds were present in them. Two of the samples demonstrated that they had some semi-volatile organic compounds present in them. The organic compounds present and their estimated concentrations in the soil are listed below. All concentrations are expressed in mg/kg and reflect the amounts that are expected to be present in the samples if they are completely devoid of moisture. The soil sample that was not analyzed was labeled, "Corner of Hwy 242 and Industrial Park Road".

Southeast corner of storage pad

2,5-Cyclohexadiene-1,4 dione, 2,6-Bis(1,1-Dimethylethyl)	2
Bis (Dimethylethyl) Benzenediol	2
2-Dibenzofuranamine	7
4-Dibenzofuranamine	5

North side of tank TB112

Dichloronitro Benzene	1
Bis(Dimethyl ethyl) Benzenediol	5
1,1'-(2,2-Dichloroethylidene) Bis (4-methoxy) Benzene	95
Diphenyl Sulfone	3000